EDISON ELECTRIC INSTITUTE BULLETIN

INDUSTRIES

MAY, 1940

The Atlantic City Convention 185
The National Power Sales Conference . . . . . C. E. GREENWOOD 192
The Executive Interest in Power Sales . . . . . H. M. SAWYER 193
Diversity Versus Integration . . . . . C. W. KELLOGG 195
Meeting Competition in Refrigeration and Air Conditioning Field . H. CHESTER GAUSE 197
Steam Competition . . . . . P. D. LAWRENCE 201
Improve Your Industrial Sales Methods to Increase the Net Income of Your Company W. A. MOORE 207
Selling Industrial Lighting . . . . . ROY A. PALMER 210
The Fluorescent Lighting Situation . . . . . M. N. WATERMAN 213
State Regulation of Gas and Electric Companies in Connecticut . . . . . J. W. ALSOP 217
The Electric Utilities' Exhibits at This Year's New York World's Fair 219
The Annual Meeting of the Engineering Committees . . . . ALEXANDER MAXWELL 221
Accident Prevention Committee Meeting . . . . . W. R. SMITH 222
Electrical Equipment Committee Meeting . . . . . H. L. WALLAU 223
Meter and Service Committee Meeting . . . . . A. B. CRAIG 224
Transmission and Distribution Committee Meeting . . . . . W. F. NIMMO 225
Prime Movers Committee Meeting . . . . . E. L. HOPPING 226
Dancing Conductors . . . . . R. N. CONWELL 227
The Joint Corrosion Committee for Electrolysis Mitigation . . . . . M. W. GHEN 231
Resuscitation Review Board is Appointed 234
Testing Rubber Gloves with High Voltage D-C . R. W. CHADBOURN and W. H. MEADE 235
Edison the Man : 240
Portland General Electric Company Emergency Trouble Dispatching Network W. A. LEIDIGH, JR. 241
Accounting Notes 245
Personals 247

Conventions and Meetings, 248

EDISON ELECTRIC INSTITUTE

THE ELECTRIC LIGHT AND POWER INDUSTRY

Current Statistical Data Covering 100 Per Cent of Industry

SOURCE AND DISPOSAL OF ENERGY

(Data undergoing revision as to classification of industry generating plants and form of presentation.)

CLASSIFICATION OF SALES (Revised Series)

	1940	1939	%
Number of Customers as of January 31st			
Residential or Domestic	24,065,225	23,306,040	+ 3.3
Rural (Distinct Rural Rates)	639,675	543,053	+17.8
Commercial or Industrial:			
Small Light and Power	4,197,642	4,152,603	+ 1.1
Large Light and Power	180,194	185,587	− 2.9
Street and Highway Lighting	24,234	24,685	.....
Other Public Authorities	88,998	76,902	.....
Railways and Railroads:			
Street and Interurban Railways	207	231	.....
Electrified Steam Railroads	31	29	.....
Interdepartmental	1,137	1,116	.....
Total Ultimate Customers	**29,197,343**	**28,290,246**	**+ 3.2**
Kilowatthour Sales During Month of January			
Residential or Domestic	2,185,994,000	1,996,581,000	+ 9.5
Rural (Distinct Rural Rates)	97,988,000	76,117,000	+28.7
Commercial or Industrial:			
Small Light and Power	1,934,158,000	1,749,717,000	+10.5
Large Light and Power	4,753,665,000	3,925,597,000	+21.1
Street and Highway Lighting	207,634,000	202,506,000	+ 2.5
Other Public Authorities	235,051,000	202,175,000	+16.3
Railways and Railroads:			
Street and Interurban Railways	404,815,000	375,702,000	+ 7.7
Electrified Steam Railroads	179,623,000	158,548,000	+13.3
Interdepartmental	67,602,000	63,939,000	+ 5.7
Total Ultimate Customers	**10,066,530,000**	**8,750,882,000**	**+15.0**
Revenue from Ultimate Customers	**$213,096,900**	**$199,142,700**	**+ 7.0**

RESIDENTIAL OR DOMESTIC SERVICE (Revised Series)

Average Customer Data for the 12 months ended January 31st			
Kilowatthours per Customer	902	859	+ 5.0
Average Annual Bill	$35.90	$35.80	+ 0.3
Revenue per Kilowatthour	3.98¢	4.12¢	− 3.4

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EDISON ELECTRIC INSTITUTE BULLETIN

Volume 8 MAY, 1940 No. 5

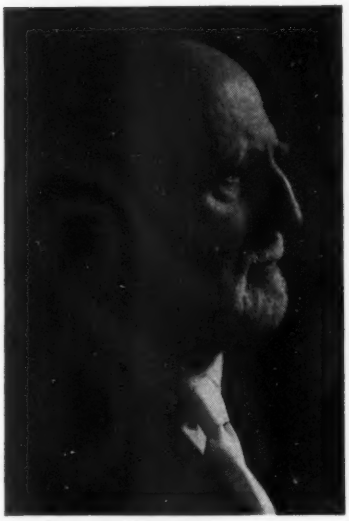
The Atlantic City Convention

Problems of the Industry and Their Relation to National Economy To Be Thoroughly Discussed

UNUSUAL events in this country and abroad establish a momentous undertone for any national meeting at this time. The program for the Eighth Annual Convention of the Institute to be held at Atlantic City the first week in June reflects this feeling by providing for a thorough re-examination both of the internal problems of the industry and of their relation to American economy as a whole. Twenty-five speakers will occupy the platform in turn during the seven sessions and each address will present an authoritative view on a topic of vital importance.

Executives of electric utility companies all over the nation will be present, as will representatives of other parts of the electrical industry, and preparations are being made to accommodate an attendance of more than 2000. The general and special sessions will be open to all, including non-members of the Institute to whom President Kellogg has extended a special invitation to attend.

In contrast to last year's meeting in New York, at which World's Fair activities prompted concentration of the business program, the 1940 schedule provides five general sessions, beginning Tuesday morning, June 4, and concluding Thursday, June 6. A special evening session will be held Wednesday evening, June 5, and as a final event, a luncheon meeting Thursday afternoon.



ALEX DOW
The Detroit Edison Company
"SOME OF MY PREJUDICES

Some of the subjects to be discussed at the general sessions are: economic trends in the utility industry, advances in power generation, continuity of service as related to its costs and value, the industry's human problems, the development of commercial and industrial markets, the use of employer's experience ratings in unemployment compensation, the power engineer's contribution to the progress of electric service, cooperative electrical research, utility operations in the Northwest, possible conditions in American business after the end of Europe's war, the distribution engineer's responsibilities, public relations through employee information, the relation of sight to light from an educator's viewpoint, methods of utility depreciation, cost and depreciation accounting, the present rate situation, and the attacks on private enterprise.

Time during Convention Week not accounted for by sessions and committee meetings will not be plentiful, but those who desire entertainment can find it in several forms. There will be dancing at the Hotel Traymore, Monday and Tuesday evenings. Tea for the ladies will be served in the Traymore's Fountain Room Tuesday afternoon, with a general gathering there after the day's business session ends. At the special session in Convention Hall on Wednesday evening, a forty-five minute musical program will be presented. The artists who will perform are nationally known: Miss Margaret Speaks, radio and concert soprano; Benar Heifetz, solo cellist of the Philadelphia Orchestra, and Karl Bonawitz, concert organist.

Delegates and guests who wish to visit the new edition of the New York World's Fair may do so conveniently during the week-end following the convention. Immediately after the Thursday luncheon, a special train will leave Atlantic City for New York. The Fair has designated Friday, June 7, as Edison Electric Institute Day, and the electric utility exhibits, completely revamped for 1940, are even more worthwhile than they were last year.

As has been their custom at past conventions at Atlantic City, members of the staff of the Atlantic City Electric Company, headed by Mr. E. A. Lewis and Mr. R. E. Swift, are cooperating to the fullest extent in convention preparations, and the Institute staff will be glad to render any possible service to delegates.

Monday, June 3, will be given over to registration and committee meetings, information on which is carried elsewhere on this page. The program of the regular sessions follows.

First General Session—Tuesday Morning

The first session will be called to order promptly at 9:30 a.m. Tuesday, June 4. The treasurer's report will be presented by Mr. F. H. Nickerson, Consolidated Edison Company of New York, Inc., who will be followed by President Charles W. Kellogg with the presidential address to the Convention. Mr. C. L. Campbell, President, The Connecticut Light and Power Company, will then speak on "The Danger in Uniform Accounting."

"The Practical Way Out" is the subject chosen by Mr. Charles E. Wilson. Beginning in 1899 as an office boy, working his way up through most of the functions of the electrical manufacturing industry and in many capacities, to become the executive head of one of the country's greatest enterprises, Mr. Wilson has the background and the experience to justify the exposition of his theme.

Mr. Edwin Vennard, who will close this session with a discussion of economic trends in the electric industry, is well qualified to treat such a broad subject. As Vice President of the Middle West Service Company, which serves a large group of utilities, his field of direction includes rates, advertising, employee information and customer relations activities.

Second General Session—Tuesday Afternoon

Beginning at 2:30 p.m., this session will hear five speakers. Four of the addresses will bear on major activities of electric utility companies and the subject of the fifth vitally concerns all American business. Mr. E. L. Hopping of the Philadelphia Electric Company, who is Chairman of the Prime Movers Committee of the Institute, will be first, telling how and why "Power Generation Advances." Mr. H. R. Woodrow, Vice President, Consolidated Edison Company of New York, Inc., will be the second speaker. His subject, "Continuity of Service as Related to Its Cost and Value," is one of major importance to every electric utility, and his long experience as an engineer and executive has

CONVENTION SCHEDULE

EIGHTH ANNUAL CONVENTION
EDISON ELECTRIC INSTITUTE

When and Where—Atlantic City, N. J., June 3, 4, 5 and 6. All general sessions in Convention Hall (Atlantic City Auditorium).

Hotels and Transportation—Circulars giving information as to train and plane schedules, hotel reservations and rates, have been mailed to member companies. Additional copies will be sent upon request.

Registration—Opens 9:30 a.m., Monday, June 3, in the main lobby of Hotel Traymore. Continued Tuesday, Wednesday and Thursday at Convention Hall, beginning at 8:30 a.m. Ladies also should register and obtain convention button for admission to social events.

Business sessions—Five: Tuesday morning, 9:30 a.m.; Tuesday afternoon, 2:30 p.m.; Wednesday morning, 9:30 a.m.; Wednesday afternoon, 3:00 p.m.; Thursday morning, 9:30 a.m.

Special session—Wednesday evening, 9:00 p.m., in Convention Hall. Musical program and guest speaker.

Luncheon meeting—Thursday afternoon, 1:00 p.m., in American Room of Hotel Traymore. Tickets, $3.00 each, should be purchased at Registration desk as early as possible. Special train to New York at 2:55 p.m.

Recreation—Tea for the ladies in Fountain Room of Hotel Traymore, Tuesday, 4:00 p.m., followed by general gathering. Admission by convention button only. Dancing in Fountain Room and Terrace Monday and Tuesday evenings, beginning 9:00 p.m.

COMMITTEE MEETINGS

At the Convention

Monday, June 3rd

Employment Committee, 10 a.m., Parlor "A", Mezzanine, Hotel Traymore.

Executive Committee, Modern Kitchen Bureau, 3 p.m., Club Room, 10th Floor, Hotel Traymore.

General Accounting Committee, luncheon-meeting, 12:30 p.m., Belvedere Room, 11th Floor, Hotel Traymore.

General Sales Committee, luncheon-meeting, 12:30 p.m., Mandarin Room, Mezzanine, Hotel Traymore.

Plan Committee, Modern Kitchen Bureau, 9:30 a.m., Rose Room, Mezzanine, Hotel Traymore.

Plant Accounting Committee, 2:30 p.m., Rose Room, Mezzanine, Hotel Traymore.

Rate Research Committee, 10:30 a.m., Chippendale Room, Mezzanine, Hotel Traymore.

Special Meeting, Operating Committee, 2:30 p.m., Stratosphere Room, 8th Floor, Hotel Traymore.

Tuesday, June 4th

Operating Committee, 12:45 p.m., luncheon-meeting, Club Room, 10th Floor, Hotel Traymore.

Wednesday, June 5th

Board of Trustees, 1 p.m., luncheon-meeting, Club Room, 10th Floor, Hotel Traymore.

KINSEY M. ROBINSON
Washington Water Power Company
"PUBLIC UTILITY PROBLEMS IN THE NORTHWEST"

CHARLES W. KELLOGG
Edison Electric Institute
"THE PRESIDENT'S ADDRESS"

F. H. NICKERSON
Consolidated Edison Co. of New York, Inc.
"REPORT OF THE TREASURER"

supplied him plentifully with data to support his exposition.

Mr. Paul M. Downing, Vice President and General Manager, Pacific Gas and Electric Company, San Francisco, the third speaker, will come from the Pacific Coast to discuss the one subject of basic importance to all utility operations. He will talk on "Human Problems of the Utility Industry."

The commercial and industrial markets for electric power, a phase of load building that becomes more important every year, will be analyzed by Mr. George Ousler, General Sales Manager, Duquesne Light Company, Pittsburgh. He will outline a method for approaching the fuller development of these rich fields.

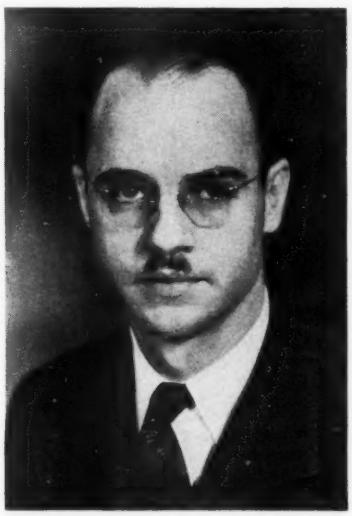
The last speaker at this session is a specialist in a subject which has demanded the attention of employers all over the country recently—unemployment compensation. Mr. R. W. Leach is President of Unemployment Benefit Advisors, Incorporated, which has been providing industry with expert advice and service since 1933. He believes that, unless leading executives act promptly, individual employer experience will be eliminated as a factor in compensation and there is grave danger that a completely nationalized system will be substituted for the present federal-state set-up.

Third General Session—Wednesday Morning

At the opening of this session, 9:30 a.m., the Convention will receive the report of the Nominating Committee and then proceed with the annual election of trustees, filling those posts in which terms expire this year.

Four addresses will follow. Under

BERNARD S. RODEY, JR.
Consolidated Edison Co. of New York, Inc.
"ONE WAY STREET"



JAMES M. STAFFORD, JR.
Georgia Power Company
"I WOULDN'T KNOW ABOUT THAT"

C. E. KOHLHEPP
Wisconsin Public Service Corporation
"SO DEPRECIATION IS A TECHNICAL PROBLEM!"

COLONEL ROBERT S. HENRY
Association of American Railroads
"THE 'FIFTH COLUMN' AND PRIVATE ENTERPRISE"

HOWARD COONLEY
National Association of Manufacturers
"LET THERE BE LIGHT"

PAUL M. DOWNING
Pacific Gas and Electric Company
"HUMAN PROBLEMS OF THE UTILITY INDUSTRY"

the title, "More and More for Less and Less," Mr. H. L. Wallau, Chief Executive Electrical Engineer for The Cleveland Electric Illuminating Company, will review the contributions made by power engineers in bringing electric service at progressively reduced costs, and state his opinion as to what they may expect to achieve in the future.

Mr. Ralph Kelly, Vice President, Westinghouse Electric and Manufacturing Company, will stress the cooperation between electrical manufacturers and utility operators in developing new applications, to the benefit of themselves and the general public.

The problems of public utility operations in the Northwest will be discussed by Mr. Kinsey M. Robinson, President, The Washington Water Power Company, Spokane.

A consulting economist and former professor of finance at the University of Chicago, who is the author of many books on economic, social and industrial problems, is the final speaker for this session. Dr. Lionel D. Edie will look ahead to the conditions American business must expect to face when peace finally comes to Europe.

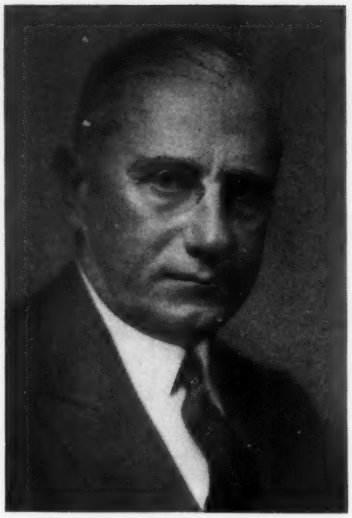
Fourth General Session—Wednesday Afternoon

This session begins at 3 p.m. The distribution engineers of the electric industry have met each new responsibility placed upon them by the rapid expansion of electric service. Mr. Howard P. Seelye, Senior Engineer, The Detroit Edison Company, speaks on this topic with the authority of twenty-four years' experience with distribution problems.

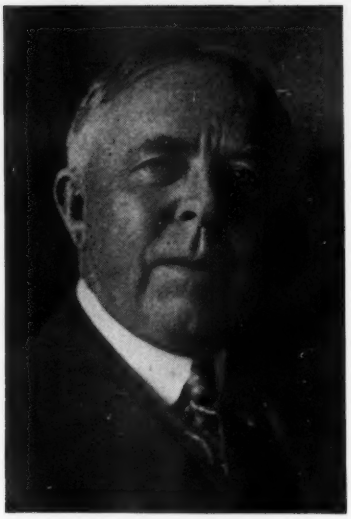
GEORGE W. OUSLER
Duquesne Light Company
"AN APPROACH TO THE DEVELOPMENT OF THE COMMERCIAL AND INDUSTRIAL MARKETS"

DR. HUGH G. ROWELL
Teachers College, Columbia University
"THE RIGHTS OF THE EYE"

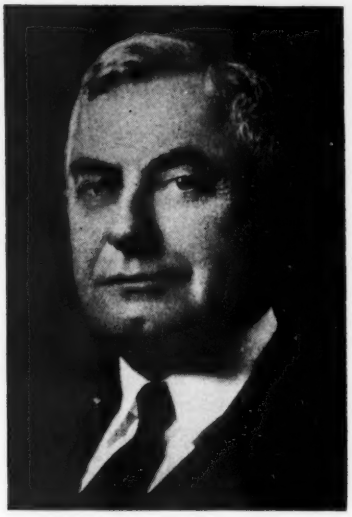
ROBERT W. LEACH
Unemployment Benefit Advisors, Inc.
"UNEMPLOYMENT EXPERIENCE RATING IN JEOPARDY"



H. P. LIVERSIDGE
Philadelphia Electric Company
"REPORT OF PRIZE AWARDS COMMITTEE"



SAMUEL FERGUSON
Hartford Electric Light Company
"FIFTH COLUMN TACTICS IN ORIGINAL COST AND DEPRECIATION ACCOUNTING"



C. L. CAMPBELL
The Connecticut Light and Power Company
"THE DANGER IN UNIFORM ACCOUNTING"

Surely it is a rare utility employee nowadays who answers a question about his business with, "I wouldn't know about that!" but this is the title Mr. James M. Stafford, Jr., Assistant Advertising Manager of the Georgia Power Company, has assigned to what will be a treatment of employee educational fundamentals and practice in the second address of the afternoon.

Dr. Hugh Grant Rowell, Assistant Professor of Education at Teachers College, Columbia University, will present the viewpoint of a medical man and educator on the Better Light-Better Sight program. In his work with the education of handicapped children, Dr. Rowell has made an exhaustive study of the relation of sight to light. His provocative title is "The Rights of the Eye."

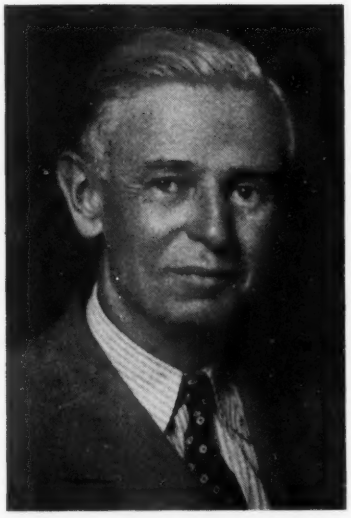
"So Depreciation Is a Technical Problem!" is the challenge given by Mr. C. E. Kohlhepp, Vice President and Controller of The Wisconsin Public Service Corporation, who believes it is rather the vital concern of utility management and investors.

Should accounting be a one-way street? Mr. Bernard S. Rodey, Jr., Associate Controller, Consolidated Edison Company of New York, Inc., will have a stimulating answer to present in his address closing this session.

Special Session—Wednesday Evening

At 9 p.m. the delegates and their guests will again assemble in the ballroom of Convention Hall. Three na-

EDWIN VENNARD
Middle West Service Company
"ECONOMIC TRENDS IN THE ELECTRIC INDUSTRY"



F. A. NEWTON
Commonwealth and Southern Corporation
"1940 RATES—DRIFTING OR SAILING"

H. R. WOODROW
Consolidated Edison Co. of New York, Inc.
"CONTINUITY OF SERVICE AS RELATED TO ITS COST AND VALUE"

DR. LIONEL D. EDIE
Consulting Economist
"AMERICAN ECONOMIC PROBLEMS IF AND WHEN PEACE COMES"

C. E. WILSON
General Electric Company
"THE PRACTICAL WAY OUT"

RALPH KELLY
Westinghouse Electric and Manufacturing Company
"THE AMERICAN WAY OF WORK"

tionally known concert artists, Miss Margaret Speaks, soprano; Mr. Benar Heifetz, solo 'cellist, and Mr. Karl Bonawitz, organist, will give a forty-five minute musical program. Following this, a distinguished guest of the Convention, Mr. Howard Coonley, Chairman, National Association of Manufacturers, will address the assemblage, under the title, "Let There Be Light."

Fifth General Session—Thursday Morning

The first event of the last general session, which opens at 9:30 a.m., will be the presentation of the officers chosen to head the Institute for the ensuing year.

Rates and rate structures are a subject of continuing importance to the industry. Whether or not present rates are in line with today's actualities will be the concern of Mr. F. A. Newton, Rate and Valuation Expert of The Commonwealth and Southern Corporation, when he speaks on "1940 Rates—Drifting or Sailing?"

Mr. Samuel Ferguson, President, The Hartford Electric Light Company, will bring the subject of depreciation accounting again under the platform spotlight, to point out its facts and fallacies.

The Convention will be reminded that another industry must operate under governmental regulation when it hears Colonel Robert S. Henry, of the Association of American Railroads, whose address has a title reminiscent of today's newspaper headlines "The 'Fifth Column' and Private Enterprise."

Mr. H. P. Liversidge, President, Philadelphia Electric Company and

E. L. HOPPING
Philadelphia Electric Company
"POWER GENERATION ADVANCES"

H. P. SEELYE
The Detroit Edison Company
"DISTRIBUTION MEETS ITS RESPONSIBILITIES"

H. L. WALLAU
The Cleveland Electric Illuminating Company
"MORE AND MORE FOR LESS AND LESS"

Chairman of the Prize Awards Committee of the Institute, will then take over and engineer the presentation of the Charles A. Coffin Award, and the six other awards and prizes administered by the Institute. These include the B. C. Forbes Public Relations Prize; the James H. McGraw Prizes; the R. B. Marshall Award, George A. Hughes Award, the Augustus D. Curtis Award, the Thomas W. Martin Award, and the National Electric Water Heating Award of the Modern Kitchen Bureau.

Luncheon Meeting—Thursday Afternoon

At 1 p.m. the final event of the Convention, a luncheon meeting, gets under way in the American Room of the Hotel Traymore. The featured speaker here will be the dean of the electric utility industry, Mr. Alex Dow, Chairman of the Executive Committee, The Detroit Edison Company, who will tell about some of his prejudices—to the delectation of those fortunate enough to hear him.

Just as we go to press, Mr. Dow informs the editor that he has made a draft of his talk, but inasmuch as he was never known to stick to a prepared paper he thinks divulging it in advance would be misleading. The draft does show him, he says, as acknowledging a number of prejudices, technical, business and social, without in any way asking that they be accepted by his hearers. He acknowledges that some of them conform to the Johnsonian definition of prejudices, in that they may be premature or biased.

Of technical prejudices he named a very few, saying that a lunch time talk with no provision for the audience to talk back to the speaker, is not a good place for technical presentations. Of his business prejudices he lists one against numerous memberships for committees or boards of directors; against the man who insists on saying 'I told you so'; against the other man who insists on criticizing past decisions in the rear-end light of present knowledge; against any over rigid business organization; and some others even more provocative.

He says he does not expect that his audience will agree with him. Maybe not, but the odds are heavy that he will keep his audience on its toes.

Adjournment will come in time for those so desiring to board the special train which will leave for New York at 2:55 p.m., standard time.

Not Strictly Business

For Lighter Moments at the Convention

KARL BONAWITZ

MARGARET SPEAKS

BENAR HEIFETZ

ALTHOUGH delegates and guests attending the Institute's convention at Atlantic City the first week of June probably will not feel time hanging heavily, due to the solid program of the sessions, they will find the famous boardwalk only a few steps from Convention Hall, and arrangements have been made for diversified recreation and entertainment indoors. The Fountain Room and Terrace of the Hotel Traymore will be the scene, Tuesday afternoon, of a tea for the ladies attending the convention. The delegates will join the gathering after the conclusion of the Tuesday afternoon business session. On both Monday and Tuesday evenings there will be dancing in the Fountain Room, beginning at 9 p. m. A social atmosphere also will prevail at the convention's final event, the luncheon meeting Thursday, in the Traymore's American Room.

The entertainment feature of the convention program will come Wednesday evening at the special session in the ballroom of Convention Hall. Preceding Mr. Howard Coonley's address, three celebrated artists will present a varied musical program. Margaret Speaks, soprano, is known to radio listeners all over the country through her years as featured soloist on the Firestone program, and television will offer her no difficulties, as the picture above testifies. She is the niece of Oley Speaks, famous American composer, and it is traditional by now that his song, "Sylvia," appears on all Margaret Speaks programs. Benar Heifetz has been for years the solo 'cellist of the Philadelphia Orchestra. The name of Karl Bonawitz, concert organist, also is one familiar to millions of music lovers.

The National Power Sales Conference

By C. E. Greenwood
Commercial Director, Edison Electric Institute

LIVING in an Industrial Age such as we are today, we have witnessed stupenduous developments in industrial processes and machinery to perform them. Looking ahead one is convinced of greater achievements to follow. Sheet steel is fed into one end of the process line and comes out containers packed for shipping to other factories. Raw fruit and vegetables started at one end of a line of processes, end up cooked to a turn and sealed in these same cans for delivery to food stores. Paper containers for our milk supply start somewhere as pulp. Man-made machines do the rest.

Multiply these industries by the thousands and one has some realization of the amazing increase in power applications. The knowledge of the power engineer must expand in order for him to keep pace with industry itself. The electric utilities' stake in this industrial growth is indicated in the fact that in 1939 sales of energy to industry represented approximately 50 per cent of the total kilowatt hours sold and 26 per cent of gross revenues. Therefore the industrial engineers and the power salesmen come to the front as vital factors in the load building efforts of the utility.

It has been the practice of the Institute for the past few years to devote at least an entire day at each Annual Sales Conference to a discussion of the foremost problems in the scheme of obtaining and holding industrial power business. But our Industrial Power and Heating Committee concluded that one day was not sufficient to cover the high lights in power sales technique and for analyzing competitive situations that confront men on "the firing line."

With the purpose of creating the opportunity for a meeting of minds among national and local utility representatives in the power sales field, the Industrial Power and Heating Committee of EEI accepted the invitation of the Southeastern Electric Exchange for a joint Power Sales Conference which was held at the Hotel Roanoke, Roanoke, Va., on April 25-26. This Conference was for utility men only and 210 representatives from 28 States answered the call. C. H. Purdy, Consumers Power Co., Jackson, Michigan, the Chairman of the Industrial Power and Heating Committee, was general presiding officer the opening day. He called on Charles Snyder, Monongahela West Penn Public Service Co., Fairmont, West Va., Chairman of the Program Committee, to introduce the speakers.

The Program opened with a Welcome from Edwin M. Clapp of Georgia Power Co., Atlanta, Ga., Chairman of the Industrial Power Committee of the Southeastern Electric Exchange, co-sponsor and host at the Conference. Mr. Clapp had been a stem-winder in the preparation of the Conference and gave the answer to WHY ARE WE HERE. He was followed by Harris E. Dexter, Vice President of Central Hudson Gas & Electric Corp., and Chairman of the General Sales Committee of EEI, who, in an informal talk, impressed the alertness required of the power salesman as the field of competition expands, and the need of a balanced sales program between power and other promotional effort of sales departments in the utility company.

H. M. Sawyer, Vice President, American Gas & Electric Service Corp., followed with a keen analysis on the "Executive Outlook" outlining the contrasting duties of residential salesmen and the more conservative and fact-dealing job of the power engineer. Mr. Sawyer pointed out that executives were giving more consideration to the work of power sales departments. The morning session closed with a presentation by H. S. Bigelow of Sales Analysis Institute, New York City, in which he visualized with an assistant the right and wrong methods of productive selling.

The afternoon session of the first day was opened by Roy A. Palmer of Duke Power Co., Charlotte, N. C., on "Selling Industrial Lighting And Its Value As An Entrance For Complete Plant Electrification." The power salesman must know his lighting which is an important part of the industrial load. A lighting engineer is always available if there is a special job to be done, but lighting knowledge is an asset to the power salesman, and of additional value as an entering wedge to the sale of further power and heating applications. There are thousands of factory prospects for re-lighting. It was fitting that fluorescent lighting developments that have such wide application in industrial establishments should be included on the program. THE FLUORESCENT LIGHTING SITUATION is one that should be as familiar to the power salesman as to those who are primarily engaged in the sale of light, and an outline of the controversy that developed with the introduction of this new light source, together with the resultant discussion which was crystallized in a Resolution by the EEI Sales Committee defining its policy in promotion, was ably presented by M. N. Waterman of Central Hudson Gas & Electric Corp., Poughkeepsie, a member of EEI Lighting Sales Committee.

The balance of the afternoon session of the first day was given over to presentations on RECENT DEVELOPMENTS IN INFRA-RED HEATING. Here again was an application in heating which is attracting wide attention. Although it might be considered in the earlier stages, it is recognized that there is an expansive field for such applications and further opportunity for study and research. Hugh Archer of Detroit Edison Co., Detroit, Mich., discussed "RECENT DEVELOPMENTS"; C. L. Lane, Virginia Electric & Power Co., Richmond, "SELLING INFRA-RED HEATING IN RICHMOND"; A. F. Fervier, Monongahela West Penn Public Service Co., discussed the selling of this class in Wellsburg, West Virginia, and Charles Russell, Philadelphia Electric Co., "SELLING IN PHILADELPHIA." These four experienced engineers covered the subject comprehensively. Open discussion followed.

At the morning session of the second day of the Conference the general theme was COMPETITIVE POWER. The opening speaker was Thomas Burns, American Gas & Electric Service Corp., New York City, who presented a scholarly discussion on "FUNDAMENTALS OF MEETING COMPETITION." H. C. Gause, Alabama Power Co., Birmingham, revealed the

(*Continued on page* 244)

The Executive Interest in Power Sales

By H. M. Sawyer
Vice President, American Gas and Electric Company

Address before the National Power Sales Conference, Roanoke, Va., April 25, 1940

MEETINGS of this kind are broad in scope. They entail an exchange of views going beyond the technology of the art iself. For here we discuss the problems of the engineer in business—the business of being an engineer. Perhaps this is the forerunner of other meetings which will open the door to the idea of amplifying this committee's activities, recognizing the principle that power engineers in the public utility business are in a class somewhat removed from their more strictly professional brothers in other engineering activities.

Your program committee has entitled the remarks that I am to make as the "Executive Outlook." Possibly the committee desired an expression of opinion on what might be expected to happen in the electric utility business. With the rapidly changing conditions throughout the world, it is hazardous to pose as a prophet, but it does seem to me that there are definite indications of what may be before us. In determining trends for the future, one must study events of the past, and to my mind, this industry has always had its milestones and sign-posts. Sometimes they have been obscured in a fog of uncertainty but they have been none the less existent. This industry has always gone forward. It will go forward now because it is still on a sound basis, although there are pitfalls to be avoided.

In the face of difficulties in the financing of new construction, due in a major degree to the uncertainties thrown about us by the attitude of some exponents of public power, we have built our facilities to a high degree of perfection. Today there is no shortage of power, and there would be none were we to be so unfortunate as to become involved in war. Generally our customers do not complain of the cost of service. Even the hearings before public bodies have taken on a degree of understanding we could not have foreseen a short time ago.

This is an industry developed mainly around engineering principles and this fact gives the power engineer outstanding advantages with correspondingly heavy responsibilities. I think I speak a truism when I say that the combination of salesmanship with his engineering training and background provides him with opportunities not open in most other branches of the public utility industry. He should recognize his position and carefully nurture the responsibility placed upon him.

A most important ingredient of the electric utilities' success has been service to its customers. I do not limit this term to the physical facilities that provide continuity, perfection of voltage regulation, constancy of frequency, and those other elements of physical delivery that you know so well. I am thinking broadly in the terms of the service that you, as power sales engineers, render to your customers. Your job is one of constant customer education; not in new applications alone, but in all aspects of his purchase of power.

The power sales engineer is often accused of being too conservative. He is sometimes called a "bourbon," as contrasted with his confrere in the residential sales field of the public utility business. What the power engineer sells has no eye appeal; his selling is not product selling but service selling. I think this is a good balance. He *must* be a conservative in the best sense because he deals with facts and figures; but he must be liberal in his approach to the points of view of others. Let us take a few examples.

In the matter of rate-making, with which you have had much to do for years—because of previous court decisions, reproduction value new, less depreciation, has been considered the major item in establishing a rate base, but recently two other elements, also recognized in the past, have taken on more weight in the thinking of our regulatory bodies; namely, some variation of the prudent investment theory and, more particularly, the original cost theory of arriving at property values.

New theories of depreciation accruals are constantly being advanced or, shall I say, new methods of the application of old theories. Straight-line, age-life depreciation is no longer considered the only, or major, method, and certain of our regulatory bodies believe strongly in a so-called sinking-fund method. Between these two extremes there is a vast field of new depreciation ideas. Most of us have a new classification of accounts that came into being some three years ago and which is now generally applied throughout the country.

In this new thinking, we must be wise and acquire to ourselves full and complete knowledge of the methods and ideas now popular. I believe the regulatory bodies have recognized to a greater degree than heretofore, the many competitive angles of our business. This is borne out by the acceptance of provisions in our rate tariffs for more equitable standby charges and other provisions to protect all our customers, as well as the company, against that customer who leans upon us for insurance although he has his own plant. Another evidence of the sound thinking and care with which regulatory bodies are approaching our problems is the provision in some states for power factor correction on fluorescent lighting. These are but two of the many matters now receiving considered action.

On the executive side, I find constantly more careful consideration of the work done by the power sales departments of our companies; but there is an inclination on the part of some chief executives for concentration on the so-called intermediate business. Your committee seems to have recognized this in the program before you for these two days, for I find no paper therein that deals with large power business as such. In a talk before the Association of Edison Illuminating Companies in January, I pointed out, in considering usage classifications, that since September of 1939, countries abroad had given industrial business an impetus that had already affected and would continue to affect

materially the demands placed upon the lines of utility companies. I said in part: "We all have customers who are inquiring for additional capacity in sizable units. We must take care of these customers; that is part of the duty of a private utility company. On the other hand, we should examine most carefully the prices for which such capacity and energy are sold, to the end that if and when peace is restored we shall not find ourselves with long-term, low-priced power contracts no longer enforceable and with facilities provided to serve these customers on which earnings are no longer available."

It is true that in recent months, after the snap-back of increased large industrial load in the latter part of 1939, there has been somewhat of a drop, particularly since the first of the year. In the intermediate ground which I have mentioned, however, the growth has been satisfactory and encouraging.

This intermediate field, usually referred to as commercial lighting and power, and including among other things electric applications for small industrial heating and commercial cooking, is a field in which all of you should be particularly interested. Its possibilities for development, at realizations that are good, go beyond almost anything that the power sales departments have accomplished in the past.

I am convinced that the new development in infra-red drying calls for pioneering work on customers' premises. The development of fluorescent lighting places a definite responsibility on those of you who handle this phase of the work. It seems to me your policy must be that if fluorescence will do a better job for the customer, all things considered, then fluorescent lighting should be recommended; but it must be carefully considered so that it will progress along sound lines to the good of the industry and the industry's customers. With regard to air conditioning, much can be said as to its bad load factor and its low annual revenue return, but we are public servants and must take the doubtful with the best. The continued development in metallurgy also requires serious consideration on your part, as has been well stressed in the recent report of your power and heating committee on electric furnaces.

I am convinced that you must analyze more carefully in the future the cost of serving various classes of service in order to direct more intelligently your sales and solicitation activities. The Committee on Load Studies of the Association of Edison Illuminating Companies is producing some worth-while data on this subject and it needs the assistance, wherever possible, of the basic information which you gentlemen possess.

So much for the so-called executive approach.

Now I should like, with you, to look at the power engineer: what he *was*, what he *did*, what he *is* and what he *does*. I recently had occasion to testify at a public hearing on the acquisition of industrial loads. Early in that testimony I pointed out that the power engineer was mainly responsible for the acquisition of such loads; that in the early days his problems were largely concerned with the replacement of steam and gas engine drives with electric power, and that while the applications were not as diverse in those days as they are now, he was a pioneer working in a field which was then in the forefront of the electric arts. He had available no handbooks or textbooks of material moment from which he might secure detailed data on electric motor applications, and so he was forced to stand on his own feet and rely largely on his own experience. He was not necessarily a technical graduate, but he was a man of wide experience in the application of existing mechanical drives, the methods of testing engines, etc. In those days his customers did not have their own engineering staffs. The power sales engineer was, therefore, in a position to be a consultant to the customer. He was, in truth, a Jack-of-all-trades who could go into a customer's plant and "make it tick"—take off his coat and install a motor or rearrange a drive. We all know the results that he accomplished. The fact that, in these United States of America, by 1930 there were installed almost 5 horsepower per man employed, speaks for itself.

I find this power engineer basically the same today, but he is a broader and more versatile individual. He often has a college degree, or else a self-gained well-rounded education. The problems that he must meet are not only technical, engineering-wise, but he must know something of economics, a bit of law, some accounting, and have complete familiarity with rates and their structure. He must know his company physically, both as to its construction and as to its generation and operation. And yet he is a salesman, selling a plan. He provides his own leads, spots application, engineers the job, lays out the sales attack—and sells.

His knowledge of the utility business is basic and sound, enabling him to approach buyers with confidence; yet he speaks the buyer's language and associates equally well with foreman, chief engineer or executive. He is, moreover an ambassador of good customer-relations, and the attitude of his customers toward the company is a reflection of his effectiveness.

His duties comprise work with manufacturers' representatives, jobbers, dealers, contractors, architects, engineers, and others to promote the economical use of utility service. And because the technique of present-day negotiations with customers, existent or prospective, is specialized, he must attend schools and set up schools. He must always study.

To the power engineer, all the advantages in utility service are real. They are susceptible of concrete evaluation—they are not intangible. He is not a spellbinder and sometimes I think this is somewhat unfortunate. He does not have the gift to be as vocal as his confrere in the residential field and he may think his work unnoticed because of that. Because he deals with facts, to him honeyed words are of little value. He must sell against competition and, holding service as he does, requires greater selling ability today than in the original introduction of the use of purchased power. It means the development of interest for greater acceptance through introducing new adaptations of equipment to improve production, economy and the quality of the customer's product, as contrasted with the pioneering days of developing a different means of doing the same thing.

The power engineer is fortunate in that he must and does come in contact with every phase of our business, and being in that position, must justify the large responsibilities imposed by displaying good and sound business judgment in all of his activities. He is one of the pillars on which good management must lean in directing company affairs. He has, indeed, a chance to advance to executive stature that no other single group enjoys.

With the continued help and good judgment of the power engineer, management should and, I believe, will face the future with a high degree of assurance.

Diversity Versus Integration

By C. W. Kellogg
President, Edison Electric Institute

A talk before the Pennsylvania State Chamber of Commerce, Hershey, Pa., April 10, 1940

SINCE both diversity and integration are foundations for stability and economy in modern business, it may surprise you somewhat to have them suggested in my title as in opposition to one another. On the contrary, I believe the general experience is to the effect that each operates relatively independently of the other, that each is of definite value in our economics and that the one by no means excludes the other.

The subject is of particular interest to the electric utilities because in the Holding Company Act of 1935 integration is erected into the touchstone to test whether or not a holding company system, entirely innocent of any wrong doing under the Act, shall be allowed to live in the sense of being allowed to continue to possess and enjoy what it owns.

The status of being "integrated" is defined in the Act as that of being physically interconnected or capable of physical interconnection. Electric-holding company ownership must be limited to one such interconnected system plus such other integrated systems as (among other requirements) shall be in the same state or adjoining states.

It is clear from this that the act, by making integration an essential virtue, necessarily makes diversity a fatal vice. Since neither of these conditions of virtue or vice is associated in any way under the act with the practices the act sets out to regulate, the "Death Sentence" (implicit in the provisions just described) appears to be not only purely punitive, but to punish in many cases where no wrong doing is in question. Not only does the act, by clear implication, make diversity of investment a positive disability to the continued ownership of property, but its proponents, when the legislation was being considered by Congress and some of its administrators since its passage, have consistently contended that diversity of investment was without value or significance to utility holding companies as investment concerns. The purpose of my paper is to consider briefly the actual experience of American business in general and the utility business in particular as to the value of diversity to an investment possessing that characteristic.

The word "diversity" expresses the thought contained in the old adage about "not having all your eggs in one basket." The very fact that there is such an adage shows that the appreciation of the value of the principle of diversification is as old as human experience. In our modern business world the almost endless diversification of holdings by investment companies, the well established practice of life insurance companies to spread their funds not only among a variety of investment channels, but throughout a wide geographic range, the familiar practice of fire and accident insurance companies to reinsure all individual risks over a given size—these and many similar methods in other lines of business are all designed to minimize individual risks by spreading them as widely as practicable over the general field of operations. It is solely the diversity in individual requirements for cash that enables a commercial bank, while guaranteeing to pay any depositor in full at any time, to be able under ordinary circumstances to satisfy this guarantee with an amount of cash only 15 to 20 per cent as large as the letter of the guarantee would seem to call for.

Integration is also a valuable feature of business operation but its value in general depends upon principles which are entirely different from those on which the value of diversity rest. That is one reason, but not the only one, why the denial of value from diversity in glorifying integration, as is done in the Public Utility Holding Company Act, is illogical, since one does not exclude the other; they are not related in opposition to one another, like cold to heat or night to day.

The essential value of integration is in the economies in unit cost which arise from large scale operations, such as the spreading of relatively fixed overhead costs over a large volume of product, the actual economies (especially in the electric power field) that arise from manufacturing in large quantities and those special skills and experience, which, while essential for the best results, might be economically unobtainable for a small isolated operation, although economically sound for a large integrated system. With respect to the value of integration in certain businesses, diversity enters as a factor to swell the economies of integration (such as the saving in reserve capacity and the diversity in time of occurrence of demands in electric power manufacture) but the inherent value of integration as such is entirely independent of diversity. Similarly, in specific cases, diversity might be made more effective by integration, but the inherent value of diversity is independent of integration.

While the values arising respectively from integration and from diversification depend as a rule upon different principles, yet, strangely enough, the particular kind of integration required under the public utility holding company act is distinctly enhanced by diversity. Integration under this act is defined as electrical interconnection of public utility systems or their ability to be interconnected. The three main sources of economy from such interconnection or integration are (1) the saving in charges on reserve capacity by the two or more adjoining systems being able to rely on the same reserves, (2) the operating economies arising from being able to manufacture more of the combined output from the most efficient power plants, and (3) the saving in charges on plant investment not needed due to the diversity in time of occurrence of the demands of the individual systems integrated. I might note in passing that these savings from integration, regardless of ownership, have for many years past been developed practically to the economic limit in this country. The same parties who in the Death Sentence deny any value to geographical diversity in ownership in glorifying integration of

electric systems, nevertheless dilate on the savings from load diversity arising from integration itself.

The foregoing may be put down as a mere case of unintentional inconsistency, but it becomes a matter of serious concern to those whose possession of their property is involved. Let us consider now what the record shows as to the actuality of geographical diversity as a stabilizing factor in the earnings of a group of companies possessed of such diversity. For the purpose of this study I have taken two groups of utility companies under common ownership whose individual units are greatly diversified as to geographical distribution throughout the United States from coast to coast. The variation in net earnings from year to year of one individual company would in this case represent a condition of complete lack of diversity. The magnitude of the variations of the net earnings of the combined properties, as a group, would show the relative effect of diversity. If the group showed greater stability of net earnings than the individual parts forming the group, then the difference should be the measure of the stabilizing value which was conferred on the group by diversity alone.

The first group I have taken for study consists of 13 electric utility properties under one ownership located in various parts of the United States from ocean to ocean and from the Gulf to the Canadian border—about as complete diversification geographically in our country as could well be imagined. For the ten years ending 1938 the average annual net income of the combined group was about 9 per cent less than for 1928. Yet for the same period the variations of individual properties in the group showed a much greater range. Only one of the 13 properties showed less variation than the group and their average deviation was about 22 per cent, nearly 2½ times greater than the variability of the group as a whole. Individual extremes were even greater than the average, running from 2 per cent for the most stable to 46 per cent for the least so. In ups and downs the extreme range among the 13 companies was from 38 per cent decrease to 46 per cent increase.

In the light of this showing it is difficult to maintain that diversity had no value in stabilizing the earnings of the group of utility properties in question.

Another group under common ownership that was studied did not have quite as great geographical diversity as the one first described, but still it covers a maximum range of about 2,000 miles in spread between individual companies. In this case the number of companies was 8 and the group as a whole for the ten year period ending with 1938 showed average net income 13 per cent less than 1928. Here again, however, the same relative situation was found to exist as in the first group studied. Only one of the eight properties (which showed 12 per cent decrease) was as stable as the group as a whole and the average deviation was 43 per cent, showing 3 1/3 times as great variability as the combined group. As before individual variations were even greater than their average, covering a range from 48 per cent decrease to 121 per cent increase in the ten year average net earnings compared to 1928.

Similar study made of the net earnings of the companies in and the totals for other utility holding company groups, whose properties are highly diversified geographically, shows results substantially similar to the ones I have given.

Further analysis shows that the total of twenty-one utility properties in the two holding company systems just mentioned are now in fact integrated (that is, electrically interconnected) into two groups, so that whatever the benefits are arising from electrical connection (and they are undeniably great) they have already been secured. It is not necessary for all the companies in an integrated system to be commonly owned in order to obtain the full benefits of integration, as scores of instances of many years' standing in the United States fully attest. These savings from integration arise from economic and engineering causes, not from common ownership. Enlightened self interest is what has led to the great extent of interconnection of electric properties existing in this country and it is neither fostered nor retarded by common ownership.

The value of diversity geographically however resides essentially in common ownership, since without such ownership its value disappears. The Death Sentence therefore rests on the double fallacy: on the one hand of purporting to foster through common ownership an integration which not only has been in existence for many years, but has no reference to common ownership, while, on the other hand, denying or destroying a value from diversity which the figures I have cited demonstrate to exist and which, from its very nature, arises solely *from* common ownership.

The question will inevitably arise in your minds as to why I have taken relative variability in net earnings as the basis for appraising the value of geographical diversity. The question is a fair one and its answer goes to the root of the question. The reason stability of net earnings is of such importance to utility holding companies is that the property of such companies consists largely of common stocks of operating utility companies, the net earnings available for which from year to year vary more than the return for either bonds or preferred stock. In fact, under the usual condition, where bond interest and preferred stock dividends are being earned by an operating utility, the common stock necessarily gets all the variation. Diversity is the one antidote for this condition and it has had, and if not destroyed will continue to have, a great deal to do with the investment standing of holding company securities. It is the one thing that gives to the debentures or preferred stocks of holding companies an investment standing of their own, a standing much higher than an isolated common stock could be held to possess. Similarly, the effect of diversity alone is to make the common stock of a properly set up holding company, through stabilizing earnings, as satisfactory a security as many an isolated common stock apparently better secured. This investment advantage, which hurts nobody and helps the public by making easier the raising of the essential common stock foundation for utility expansion investment, is lightly cast aside in the Death Sentence because someone had the idea that it did not exist—an idea which, as I have shown, is not supported by the actual experience over many years of the intended victims of that Sentence.

Pacific Northwest Rejects Public Ownership

ON May 17, the voters of Portland, Oregon, defeated a proposal for the formation of a utility district with the same boundaries as the city of Portland by a vote of 68,973 against and 30,278 in favor of it.

Proposals for other utility districts were also defeated in Coos County, Oregon, which voted 5,017 "against" and 2,922 "for" and Lincoln County, Oregon, which voted 1,533 "against" and 1,205 "for." Voters in the towns of Wheeler and Nehalem turned down a proposal for annexation to the Tillamook district which was formed in 1933. Bonneville Dam was to have supplied the districts with wholesale power for distribution.

Meeting Competition in Refrigeration and Air Conditioning Field

By H. Chester Gause
Alabama Power Company

A paper presented before National Power Sales Conference, Hotel Roanoke, Roanoke, Va., April 25, 1940

ALTHOUGH the art of refrigeration from nature's products and by her processes was known before the birth of Christ, mechanical refrigeration dates back to 1755 A.D., when the first experiments were performed to determine the temperature-pressure relations of certain fluids to be used as refrigerant mediums. Seventy-eight years passed before Michael Farady of England by his experiments in 1823 gave the real foundation for the development of the compression and absorption machines, when it was discovered that certain refrigerating gases could be liquefied after being compressed to a high pressure and then cooled.

Jacob Perkins, born in Massachusetts, invented in 1834 the first compression machine which used ether and is accredited with the distinction of being the first to produce refrigeration or ice in commercial quantities by mechanical means. Perkins received an English patent. Dr. John Gorrie of Apalachicola, Fla., was the first to patent an ice machine in America, which patent was granted in May, 1851, with the letters of patent to run from Aug. 22, 1850. Dr. Gorrie died before a large machine could be built, but his original cold air unit is said to have produced ice when demonstrated in a hotel in Apalachicola, Fla. Five years later in 1855, Edmund and Ferdinand Carre originated the absorption system and it is claimed the first Carre machine to be used in America was installed in Augusta, Ga., in 1863. In the years 1873-1875 the first successful ammonia compression machines were introduced by C. P. G. Linde of Germany, and David Boyle of the United States. From 1875 to 1890 many new forms of apparatus were produced and certain improvements were made. Claims are made that the first commercial ice plant employing compression refrigeration was made in Dallas, Texas, in 1878.

Until the year 1890, the practical utilization and commercial application of refrigeration were quite limited, and the development of the art of refrigeration was virtually at a standstill. In this year, the greatest shortage in the crop of natural ice in the United States occurred, and to this incident may be accredited the impetus that started the rapid development and utilization of mechanical refrigeration. By 1928, according to Ice & Refrigeration Blue Book and Buyers' Guide, there were installed in ice plants, storage plants, and industrial processes approximately 1,255,000 tons of refrigeration.

The Diesel engine, and its application to the ice industry which we have under consideration, is almost as old as the ice industry, having been invented in 1892 by Dr. Rudolph Diesel about the time nature revolted, starting the rapid development and utilization of mechanical refrigeration in the manufacture of ice. It was not until 1898 that a commercial Diesel engine was built and placed in service, so we may say practical Diesel power is 42 years old as compared to the ice industry's 50 years, dating from 1890.

A recent survey was made of power in the ice industry in Alabama with the following results:

Type of Drive	Connected HP. or *Equivalent HP.	% of Total
Natural Gas Engine .	90	0.58
Steam Absorption ...	*480	3.08
Diesel	3,100	19.91
Electric	11,900	76.43
	15,570	100.00

These data certainly do not bear out some implied claims that the ice industry has to a great extent accepted Diesel, or any form of internal combustion power, as a panacea for its power troubles. With lowered installation cost of Diesel engines brought about by volume production and lighter engines for the transportation industry, and with increased sales activities by manufacturers with well established dealer and service facilities, the electric utility faces a more real threat than ever in retaining the larger portion of the power load in the ice industry. We are always faced with threats of one kind or another and should face this particular one as Brutus did when he said, "There is no terror, Cassius, in your threats."

The oil engine salesman has troubles as great as ours, for natural gas power is far cheaper than Diesel power where the prospective user is located in a territory supplied by pipe lines from the gas fields; and as more use is made of fuel oil it will be taxed at the same rate as gasoline is today, increasing fuel cost at least 100 per cent. With his bait of expected lower power cost, he must lure an electric power consumer away from the most convenient and trouble-free form of power, compete with other salesmen of different make Diesel engines, and then in some cases before a contract can be secured compete with lower first cost and cheaper fuel consuming natural gas engine. A recent study of twenty-one (21) ice plants, located in our territory with natural gas available, having a combined load factor of 53 per cent, and enjoying an average electric rate of 1.05c per kwhr showed a paper saving of 17 per cent by gas engine power over prevailing electric power costs, representing a return of 9.3 per cent on the estimated installed cost of gas engine power equipment. With such a threat confronting us, we are still holding our electric business, and feel assured that the Diesel engine salesman cannot give us worse competition.

The ice plant is a vulnerable internal-combustion engine application for the following reasons:

1. Power cost represents roughly 50 per cent of the total manufacturing expense. The operator has this item definitely called to his attention each month upon receipt of his electric bill. He has cut down as far as appears practical to him on his other expenses and consequently power costs must be reduced by threat or actual installation of competitive forms of power.

2. The load characteristics of the ice plant are favorable to internal-combustion engine power for:

(a) Load factors for four months during ice season approach 95 per cent, which with lower load factors during the remainder of the year, give average annual load factors in the order of 50 per cent to 60 per cent, which is considered exceptionally good.

(b) Eighty per cent or more of the total power is required by the compressor, or compressors, which permits of mechanical power drive applications, leaving the re-

maining 20 per cent for auxiliary equipment to be generated or purchased.

(c) Load is fairly constant and in this industry no premium is placed on voltage regulation or speed control.

3. Installed cost of internal-combustion engine drive has been reduced materially. A detailed study was recently made of the cost to equip 21 ice plants ranging in daily ice making capacity from 10 tons to 200 tons with internal-combustion engine drive. Mechanical drive was provided for ammonia compressor, or compressors, with engine-powered generators for supplying the ice plant auxiliary loads. In each case a small auxiliary engine was provided for power supply to auxiliaries and lighting, which would be operated when the compressor was not in use. Engine ratings were taken at 360 r.p.m. and all generators were selected at 1200 r.p.m. with direct connected exciters. Salvage value of electric motors and transformers replaced was taken at 40 per cent of present value and credited to cost of engine installation. No spare engine equipment was provided. The average net installed cost of internal-combustion engine power equipment to replace one kilowatt of central station power was found to be in case of Diesel power $92.00, and in case of natural gas engine power $90.00. This difference was made up of an average difference in installed cost of Diesel over natural gas of $10.00 per installed horsepower rating.

Let's see how bad off we are on paper in competing with internal-combustion engines in the ice plants assuming an annual load factor of 50 per cent; fuel economies based on 12 kwhr/Gal. Diesel oil, or 58.8 kwhr/MCF natural gas; maintenance at $2.00 per year per horsepower of installed engine capacity, or $3.56 per kw of purchased power; lubricating oil at 1500 kwhr/Gal. at 50c/Gal.; fuel costs based on Diesel oil at 5½c/Gal. delivered, and natural gas (960 B.t.u./Cu. Ft.) at 26c/MCF; annual fixed charges 15 per cent of Diesel power equipment at $92.00 per kw and natural gas power equipment at $90.00 per kw. Well, we face an average competition of 8.76 mills/kwhr (Gas—8.64 mills/kwhr and Diesel—8.87 mills/kwhr), as against our service at 10.5 mills/kwhr. We are apparently apart 1.74 mills/kwhr or our competition is 16.55 per cent below us.

Just what does this difference really mean? This net saving of 1.74 mills/kwhr at 50 per cent load factor means a net return of $7.62 per kw/year, or the net return from the customer's power venture would return his average capital of $91.00 kw in twelve years. This has been taken without consideration for spare engine or generator capacity.

Is the customer content to risk the loss of plant capacity in the summer when he must make and sell all the ice he can? What does the breakdown of an operating unit without a spare mean? Plant labor and all other expense, except fuel oil and lubricating oil costs, go right on, and if the operator can, he is compelled to purchase ice of nearby competitors at a price of at least $5.00 per ton delivered. Deducting fuel and lubricating oil and miscellaneous costs at 50c per ton of ice, the operator pays at least $4.50 per ton day capacity for every ton of operating capacity that is out of service. By and large, a ton of ice making capacity requires 3.2 kilowatts, which means that each kilowatt of engine capacity on a loss-of-use basis is worth $1.41 per day. It is apparent that the saving of $7.62 per kilowatt year could be washed out in a single-compressor plant by a break-down of a prime mover requiring only a 5.4-day shut-down.

A comparison of purchased power cost and competitive power costs should be made for the sole purpose of the power sales engineer, to acquaint him with the problem at hand and the weak points on both sides. Let the power consumer do the talking about competitive power and his dissatisfaction with electric service or its cost. He has, no doubt, some apparent injustice about which he has done more thinking than you. Be a good listener and you'll find a clue that, together with a conscientious investigation at his plant, will lead to recommendations that will reduce the difference in purchased power cost and expected cost of competitive power to a point where it will not pay to make the change.

When the recommendations are finally made in writing, refrain from giving pertinent data, but give instead a thermodynamic study of the plant with estimated saving in dollars. Interpret this saving to the advantage of your purpose; for example—"This saving will pay your power bill for four months—November, December, January, and February." Of all the studies that may be made in the ice plant, I have found that a curve showing the ice tank characteristics to be the most interesting to the operator and an effective weapon in combating power competition; i.e., the daily ice making capacity with corresponding brine temperatures plotted as abscissa against suction pressure as ordinates. The operator recognizes the ice tank as the starting point. Knowing the suction pressure required by the tank to make the desired daily ice capacity, the ammonia compressor rotation may be readily calculated to supply the refrigeration to the tank and storage rooms. A large ice tank may be turned into a valuable asset when producing ice at greatly reduced ice-making capacity, for the larger number of cans per ton of output permits longer freezing time, a higher brine temperature, and a consequential increase in suction pressure which raises the density of the refrigerating gas handled, enabling more efficient operation of the compressor and a reduction in its rotation resulting in a reduction of power and energy requirements. The saving in electric energy (kwhr) required by the compressor will, in most cases, offset the increase in energy (kwhr) required by longer hours use of the installed cooling water pump or other auxiliaries, but the net result is an appreciable reduction in demand. In most cases, after such a study, it is found the operator will only have to install a smaller motor pulley at little cost to reduce his compressor rotation. He has bettered his operating condition without sacrificing any installed capacity. In a short while he can change his plant operation back to produce more ice should an emergency arise.

Whereas the average engine salesman doesn't know the fundamentals of the ice plant, the successful power engineer knows that his selling is all abstract and he must do something for his customer that the customer cannot do for himself, and that no habit or condition of a power consumer is hopeless against the use of intelligent educational effort. It is my experience that engine applications in the ice plant fail largely because the operator is so convinced at the time of his purchase that operating expenses are so low that he thereafter pays little attention to the operating conditions of the ice plant machinery, with the result that accumulating difficulties lead to an excessive amount of attention to the engine operation, at which time the ice production end of his business suffers.

Now, the application of refrigeration to air conditioning was a natural step in the progress of refrigeration, although, of course, it involved a somewhat more difficult and complicated application of refrigeration or cooling equipment.

About the year 1928, this application to air conditioning began to gain impetus, when the mechanical refrigerating capacity employed in all other uses was, roughly, 1,255,000 tons.

During the next twelve years—through 1939—this new application has accounted for approximately 750,000 tons of refrigeration, roughly 60 per cent of the total refrigerating capacity installed up to 1928 when practical mechanical refrigeration was approximately fifty years old.

As far back as the Civil War, the fundamental principles employed in modern air conditioning for human comfort were studied. A system was proposed for use

in army hospitals in 1864 by George H. Knight of Cincinnati, and described in the *Scientific American* under date of July 4, 1864. This system used ice as a source of refrigeration.

The term "air conditioning" was coined in 1907. While it was used in industrial processes principally in the past, from this time on it was not applied for comfort purposes until 1912, when the first complete air conditioning installation for comfort purposes was made in the Lutcher Memorial Church in Orange, Texas.

In applying mechanical refrigeration to air conditioning, Montgomery, Ala., boasts the first theatre installation in the world. In 1914, compression refrigeration using ammonia was used at the Empire Theater in Montgomery. Spreading from the general theatre applications around 1925 to department stores, the air conditioning industry was well on its way by 1930, and today it is employed in every type of space occupied by man at work, play or relaxation. Even the Circus is air conditioned.

Air conditioning increases its usefulness and scope in the industrial arts, one of the most recent practical applications being made in air conditioning a blast furnace. Woodward Iron Company, Woodward, Ala., installed in 1939 the first practical system maintaining a predetermined dewpoint (approximately 42 deg. F.) to air supplied to its pumping engines, supplying 2700 tons of air per day to one of its blast furnaces having a daily pig iron rating of 500 tons. This system requires about 500 tons of refrigeration. This installation was so successful that a second furnace has now been equipped.

Some of us appear a little apathetic to electric power application in air conditioning because of its seasonal nature. We should, however, always keep foremost in our minds that we must strive, at all times, diligently to preserve public acceptance of our service — electric power, the best form of power service known to man.

The public is now air-condition minded. In the purchase of air conditioning, equipment is secondary with the prime consideration being given to a condition. Electric power applied to the machinery to deliver this purchased condition relieves the user of many difficulties, real and imaginary, arising out of other forms of power. We have spent much time and money in gaining prestige for the electric industry, and we may say with a great deal of pride that the prospective users of air conditioning think of this not in terms of the application of refrigeration or other mechanical factors, but in terms of trouble-free electric service. The manufacturers of air conditioning equipment realize that the application of electric motors make possible lower first cost of installation, thereby making air conditioning more readily salable.

At a meeting of the engineers and dealers of the largest manufacturer of air conditioning equipment in the world, the following statement was made—"Electricity is cheap; use more of it, and cut down on the condenser water consumption at relatively higher rates which may be increased or consumption restricted at the will of politicians."

On a public building in our National Capital there is the inscription—"Electricity, carrier of light and power, devourer of time and space, the bearer of human speech over land and sea, greatest servant of man, itself unknown." Shall we add laurels to the usefulness of electricity or shall we, because of our lack of knowledge of future developments and conditions, say that this universally accepted form of power, electricity, cannot be successfully and advantageously used in adding to the comfort and efficiency of mankind in the art of air conditioning?

For a few minutes let's look at the direct and indirect danger that may arise out of our refusing to serve air conditioning, or even being apathetic about it. At the present time, and for some time to come, air conditioning applications will be made principally in the commercial field. Now, and we hope for the future, the commercial place of business will not want to take on the burden of electric production. If we do not encourage the application of electric power for air conditioning, but allow other forms of power to be used, we will soon find that the commercial man will gain experience in engine operation and in producing electricity, and soon service organizations will be created to relieve him of the trouble in maintenance, which is now a big factor against isolated plant application. We will also find the commercial consumer will make an ideal year-around user of the prime mover capacity required in air conditioning. It will be a fairly simple job to belt an internal-combustion engine to a refrigerating machine for use during the four or five summer months' cooling season, and use this same prime mover belted to a generator for lighting and miscellaneous power service, in whole or in part, during the remainder of the year. The increment cost of generated energy is in most cases less than the cost of purchased service at the follow-on rates. This threat makes the internal-combustion engine application more attractive, with the results that we retain the customer's lighting and small power load during the summer and only a portion of this load during the winter. With this in mind, it appears advisable to take on the seasonal air conditioning load and retain all the commercial load.

To illustrate the internal-combustion engine threat in application to air conditioning with its consequential hazard to the purchased power service already in use, I give you my Company's experience with an office building job:

1. Present service supplied	=100kw,	272,546kwhr—	$4,929	1.81c/kwhr	$49.29kw-Yr.
2. Required for air conditioning	=345kw,	405,000kwhr—	$5,703	1.41c/kwhr	$16.53kw-Yr.
3. Total:	445kw,	677,546kwhr	$10,632	1.57c/kwhr	$23.89kw-Yr.

Engineers on the air-conditioning job used the competitive power threat in an effort to make us reduce what we already considered a low rate to the level of a special air-conditioning rate in another state, which was about half our rate. To accomplish their purpose, they gave the customer the estimated operating costs for internal-combustion engine power exclusive of fixed charges and the estimated installed cost of competitive power equipment, and although not directly stated, the implication was that the power venture was sound. Outside the oil and gas fields, we did not believe any lower fuel

	Operating Expenses other than Fixed Charges Mills/kwhr		Fixed Charges Mills/kwhr		Total Mills/kwhr	
	Gas	Diesel	Gas	Diesel	Gas	Diesel
Service other than Air Conditioning	10.95	10.72	*11.03	*11.67	21.98	22.39
Air Conditioning	5.33	5.41	7.98	9.63	13.31	15.04
All Service	7.60	7.53	9.19	10.44	16.79	17.97

* Fixed charges were based on installed cost including spare engine-generator unit.

costs than oil at 4¾c per gallon and natural gas at around 25c per M.C.F. would be encountered, and were able to maintain operating figures as shown at the bottom of page 199 against competition.

It was thought that the basic data we were able to uphold in this particular negotiation might be of interest and with this in mind, and indulging in your patience, I give you the following:

	Natural Gas	Diesel
1. *Power Equipment*		
(a) For Air Conditioning		
350 hp. engine for driving compressor		
140 hp. 100 kw-3φ-240V engine-generator unit for auxiliaries.		
Estimated Installed Cost	$25,300.00	$29,800.00
Less Installed Cost 350 hp. electric motor	3,800.00	3,800.00
Excess over Electric Drive	$21,500.00	$26,000.00
Average per kw	62.25	75.25
(b) Plant to Replace All-Year Purchased Power		
2—140 hp., 100 kw, 3φ, 240V engine-generator..... (1 as spare)		
3—15 kva, 220/110V single-phase transformers ...		
2—25 kw motor-generator sets for d-c elevator service.		
Estimated Installed Cost	$22,825.00	$24,825.00
(c) Plant to Supply All Power	44,325.00	50,825.00
Average per kw	99.50	114.00
2. *Mechanical Energy Deliveries and Fuel Consumption and Cost*		
(a) For Air Conditioning		
Replacing 285,000 kwhr Comp. Use 344,000 bhp. hr.		
Generating 120,000 kwhr for Auxiliaries ..... 183,000 bhp. hr.		
Total for Air Conditioning..... 527,000 bhp. hr.		
Average Fuel Economy per bhp. hr.	11.5 cu. ft.	0.0625 Gal.
Estimated Seasonal Fuel	6061 M.C.F.	33,000 Gal.
Average Cost	25.45c/M.C.F.	4¾c Gal.
Seasonal Fuel Cost	$1,540.00	$1,568.00
(b) For Replacing General Power Purchased		
Average Fuel Economy	25 cu. ft./kwhr	8 kwhr/Gal.
Estimated Fuel to Generate 272,546 kwhr	6813 M.C.F.	34,000 Gal.
Average Cost	24.73c/M.C.F.	4¾c Gal.
Estimated Annual Fuel Cost	$1,685.00	$1,615.00

3. *Lubricating oil* was estimated on basis of 2,000 bhp. hr. per gal. @ 50c per gallon.
4. *Maintenance of power equipment* was taken at $2.00 per hp. per year of operating engine capacity. Air conditioning power equipment operating 6 months was taken at $1.00 per hp. season.
5. *No additional labor* over that required in case of purchased power was allowed for air conditioning power equipment operation. An item of $900.00 per year was allowed when generation for all other service was considered.
6. *Fixed charges* were maintained at 15 per cent on operating equipment with 10 per cent on spare equipment. However, the customer estimated as follows: Depreciation—6.67 per cent on straight-line 15-year basis; Interest on average investment giving 3 per cent annually on initial; Taxes—2.13 per cent, making a total fixed charge of 12.8 per cent, which they took at 13 per cent on operating equipment.

7. *Internal-Combustion Engine Power Cost*	*Natural Gas* Total	Mills/kwhr	*Diesel* Total	Mills/kwhr
(a) For All-Year Light and General Power Service 100 kw—272,546 kwhr				
Fuel	$1,685		$1,615	
Lubricating Oil	118		118	
Maintenance	280		280	
Additional Labor	900		900	
Total Operating Expense	$2,983	10.95	$2,913	10.72
Fixed Charges—15 per cent on operating unit, 10 per cent on spare	2,999	11.03	3,174	11.67
Total Annual Power Cost	$5,982	21.98	$6,087	22.39
Average per kw/Yr.	$59.82		$60.87	
(b) For Air Conditioning: 405,000 kwhr				
Fuel	$1,540		$1,568	
Lubricating Oil	132		132	
Maintenance	490		490	
Additional Labor	...		...	
Total Operating Expense	$2,162	5.33	$2,190	5.41
Fixed Charges at 15 per cent	3,230	7.98	3,900	9.63
Total Seasonal Power Cost	$5,392	13.31	$6,090	15.04
Average per kw/Yr. based on 345 kw	$15.63		$17.65	
(c) Total Power Cost—445 kw—677,546 kwhr....	$11,374	16.79	$12,177	17.97
Average per kw/Yr.	$26.60			$27.40

There is a bright side to the application of electric power in air conditioning. In earlier installations excessive amounts of refrigerating capacity were installed, because of the fear on the part of the air conditioning contractor of making guarantees and because the operator desired to show his patrons that his place was cool, and carried indoor temperatures far lower than necessary, or, in some cases, lower than physical resistance would permit. It will not be long before State laws will be passed prescribing the lowest temperature levels that can remain indoors with corresponding outdoor temperatures. In the past, enough refrigerating capacity was installed to take care of peak loads which might be met with one hour of compressor operation. Today, the trend is to smaller installed refrigerating plant with longer hours operation. In some cases, refrigeration storage systems have been used and have reduced the installed refrigerating capacity by as much as 40 per cent. This seems to be about the maximum reduction that can be expected. The user of air conditioning has found by experience that it is to his advantage to make the greatest possible use of his installed equipment. When air conditioning was first introduced in the State of Alabama, we designed a rate for seasonal operation of the equipment. Most of the jobs were installed for operation on a seasonal basis, but today, with the exception of a few larger jobs, all of the installations keep air conditioning equipment operating the year around. By and large, we receive an annual revenue of $21.60 per kw of power applied in air conditioning. This is not high and may dilute the commercial revenue somewhat, but, on the other hand, it may save the entire revenue from a commercial customer. It is felt that a major portion of the large air conditioning installations that may be reasonably expected in our territory have already been made, and that the smaller installations, which will represent a major part of the future volume giving us an average of $34.00 per kw, are not unattractive. We have not found that air conditioning at the present stage adds anything appreciably to our annual generated peak, and feel that it will be a great number of years before air conditioning will be such a sizable portion of the total electric load supplied that this will be the case. On the other hand, air conditioning may provide a means to offset the reduction in kwhr sales to be expected, during the transition period from incandescent to gas filled lamp.

Steam Competition

By P. D. Lawrence

Virginia Electric and Power Company

A paper presented at the National Power Sales Conference, Roanoke, Va., Apr. 25-26, 1940

COMPETITION in different parts of the country is as different as people.

What is Steam Competition? For the purpose of this paper it is that competition produced by private power plants using either steam engines or turbines to make power to drive the wheels of industry, light the lamps, and do the various heating jobs that can be accomplished by the use of electric power.

How are we going to successfully meet this competition? By *selling* the many and varied advantages of our service. To *sell* we must have salesmen, a sales organization, men on the firing line to tell the story, men who will speak in the language of the customer. Low rates and good service alone will not do the job. Many prospects don't know what their power costs are. Few keep sufficient records to enable them to determine these costs and all if properly approached will welcome the services of a power engineer to ascertain the really true costs. What is a power engineer? He is the man on the firing line, the man in the electric utility sales organization who *sells* the advantages of utility service. He is the man that shows conclusively and honestly that among other things utility service is clean, convenient, flexible, noiseless, and reliable, all of which contribute to make it economical. Time will not be taken to discuss these several salient features with the exception of convenience and flexibility. Utility service is convenient. Considerable time could be taken to elaborate on this feature of utility service; however, this point will be disposed of by mentioning that the use of utility service among other things makes it extremely convenient for the customer to keep an accurate and continuous record of production costs. He will at all times know exactly what his power costs are.

Flexible—Utility service is flexible on two scores. First, the use of electric power provides the maximum of latitude in arranging equipment and makes rearrangement simple. Second, it makes expansion possible in a minimum of time and with the least amount of planning effort and expense. The first score is not so important since it applies not alone to purchased power. But the second is one of the strongest selling points in favor of utility service. This is well expressed in the following quotation from the December 2, 1939, issue of *Electrical World*.

"The last three months have provided the utilities with the best kind of ammunition to protect the industrial market against inroads from competitive customer-owned power. When the demand for manufactured products suddenly went into high gear there was no slowing down of production because of a shortage of power. Always there was ample power for all industrial needs.

"Had these same industrials been dependent entirely upon their own power plants there would be many that would not have been able to take care of any such rapid increase in business as was experienced since September 1. The actual saving that resulted to them from the flexibility of utility power supply, if it could ever be totaled up, would be found to be several times more than any paper saving that might come from competitive power.

"When business is good and manufacturers want additional power in a hurry they automatically turn to the utilities. It is not, then, a case of how much does power cost, but, rather, how soon it can be had. In other words, there is no great competitive problem when the industrial business is good. The real problem comes when manufacturers with business at a low volume begin to look for ways to save money. They then become prospects for purveyors of competitive power equipment. The time, therefore, to prepare for such competition is when business is good and when people can understand and appreciate the advantages as and when they arrive. In other words, it is harder to convince a man about the economy of power flexibility at a time when his power needs are excessively low. The argument makes much more impression on him at the time when he needs power.

"Today manufacturers of competitive power equipment are busy in non-competitive markets, largely water and land transportation. As soon as these markets begin to level off the industrial market will once more be attacked and with greater vigor than ever before.

"This is a situation which the utilities alone must cope with. It is not like a market development job where the manufacturers of the products can be called upon for cooperation. Nobody is going to help the utilities except themselves. While their business is distinctly local, the aggregate of it is national. Moreover, there are a growing number of national organizations with local branches. Therefore, what happens in Iowa can easily affect a utility in Georgia, or in Texas, or in Massachusetts. The sales arguments in New York do not lose their effectiveness in Wisconsin. In other words, there is no Southern problem, or Pennsylvania problem, or Missouri problem, but there is a national problem.

"Since this is the time when industrial customers can best appreciate the value of utility service, this is the time then to start a national co-operative purchased power promotional program. With utility power now in favor by industry, no better time could be found for hammering home the argument."

Now is the time to sell the idea of using utility service. Once used it is difficult to operate without.

This paper covers briefly sales organization and methods used in obtaining and keeping profitable load. No attempt has been made to cover such items as power plant design, trends toward use of higher steam pressures or new and modern equipment and apparatus now available for the smaller user. These items already have been adequately covered and are probably familiar to all of you.

Selling Power

To secure new profitable load the utility must have a sales organization or contact department. It must have well equipped, loyal, enthusiastic, hard-hitting power engineers.

The power engineer should first of all acquaint himself with his own company. He should have sufficient knowledge of all of the different departments and their inter-relations. The more general knowledge he has of his company the greater value he can be to the company's customers. One of the best ways to obtain this knowledge is to work in and with these various departments. He should be entirely familiar with the types of service that are available and facilities used in delivering it to the customer. He should have an intimate knowledge of all rate schedules, terms, and conditions, rules and regulations, and contracts.

In the larger utilities especially it is desirable to make prospect surveys and arrange a definite program of activities. However, in selling power it must be remembered that any sales program will have to be flexible enough to permit the power engineer to answer calls from the customer and at all times be on the alert to meet competitive situations as they arise. The power engineer should keep records of important studies and information and arrange to exchange ideas and information with the other power en-

gineers in his own company as well as those in other companies.

Selling power whether it be meeting Steam Competition or otherwise, as most of you know, is not just the accumulation and presentation to the prospect of a lot of facts and figures. Enough information should first be obtained to decide yourself whether it is practical and economical for the prospect to purchase your product. If you can sell yourself first, you then have an even chance of selling the prospect. It has been said that the power engineer's job is 5 per cent engineering and 95 per cent selling. Just be sure you have the true facts, then concentrate on the method of presentation or approach. It *was* my opinion that a salesman was one who by some insidious means, induced the poor, unsuspecting prospect to purchase something that was of no use to him, that he couldn't afford to pay for, and would likely be better off without. It is doubtful if this be *true* salesmanship. It most certainly does not express the speaker's present thoughts.

I like to think of *"salesmanship"* as *"the fine art of letting the other fellow have your way."*

Several years ago while working for a small electric utility one of our power customers asked me whether he should purchase a 75 or 100 HP motor to replace a 50 which was considerably overloaded at times. This 50 HP motor was belted to one end of a relatively long line shaft with various machines belt driven from it. After taking in the situation, it seemed perfectly obvious to me that a more practical thing would be to purchase an additional 50 HP motor, cut the line shaft in half and belt the new motor to the other half. This I unhesitatingly recommended, pointing out the many obvious advantages. Mr. Customer did not warm up to my suggestion and said he would think about it. I went away, thinking him pretty dumb.

About a year later, this same Mr. Customer explained to me in great detail, as being his idea, the same layout that I had previously suggested to him. This, of course, disturbed me to say the least—to *think* that he would *steal* my idea. I made several attempts to tell him so, but he kept on talking so loud and fast that I finally gave up and ordered the additional 50 HP motor for him. It later occurred to me that perhaps if I had used a little tact a year before, I would have long since been selling more power.

Avoid Arguments — both with the prospect and customer as well as in their presence.

Be sure you are thinking right and then help the prospect find the answers. Let the ideas be his, just be sure he has complete and accurate data and then watch for an opportunity to guide and assist. If an opportunity doesn't show up quickly enough, "make one"—Napoleon did.

It is often said "There is strength in numbers." If several power engineers call on the customer together, the customer may become overly cautious and alarmed as a result of too much attention. In other words "Don't gang up on him."

In the final analysis it makes little difference how you get the business as long as you know it is a proper and economical step for the prospect to take. You will have this prospect or customer to live with. It is not just a matter of selling him for the day. You are inducing him to become, you hope, a permanent and satisfied customer, to purchase your product as long as he has any use for it, and you can't afford to lead him astray.

In presenting the story great care should be exercised to speak the customer's language. Find something of mutual interest. If by some slip of the tongue a term such as "power factor" is referred to and it is found necessary to explain, the boy from the farm will readily understand the story in which the baling of hay for shipment is likened to correcting power factor in which case the air in the loose hay is the wattless current.

In dealing with the problem where the customer is considering the installation of a private plant and has received several proposals, very often it will be found that the claims made in the several proposals will vary greatly, especially as to the amount of saving to be made. If the prospect's attention is diplomatically called to this fact, some question might arise in his mind as to the correctness and reliability of all the proposals.

It should be borne in mind that when the customer purchases a private plant he automatically pegs his cost in a declining market, so to speak. On the other hand, in purchasing power he places himself in a position where increased efficiencies continually make available lower power costs.

In determining the depreciation factor, obsolescence should not be lost sight of. The physical life of a power plant is not to be confused with the practical or economical life. More often than not, power plant equipment becomes obsolete long before it has been completely written off.

Furthermore, the original heat balance is apt not to be maintained because processes and products are continually changing to meet the new and different requirements of the buying public.

Occasionally a customer will object to the style of rate available. To which might be said, "Rate schedules are merely devices for collecting sufficient revenue to enable the Power Company to render the type of service required by the customer." The customer will usually agree that he is only interested in obtaining the best service at the lowest cost with the least possible effort or supervision and that his primary interest is in manufacturing the article produced in his plant.

"Keeping Profitable Business"

After the business has been obtained it is essential that very close contact be kept with the customer to retain the business. It costs a lot of money to obtain this new business and it's usually a whole lot cheaper to keep existing business than to replace it with new.

The power engineer should familiarize himself with the customer's operations and be on the lookout for opportunities to assist in every way possible in making the best and most efficient use of the service furnished. This will not only tend to keep the customer satisfied but will enable him successfully to meet competition, stay in business, and continue to be a customer. The alert power engineer will seldom pass through a plant without finding something that he can do for the customer.

In a plain goods cotton yarn mill it was found that the maximum demand was created during the first half hour of the mill's daily operating period. Casual observation disclosed that the cards were cleaned during the last half hour. The sequence of this operation was reversed and the demand materially reduced.

Two similar cotton mills owned by the same Company, but located at remote points in the same town were about to go into receivership. They were combined under one roof and a careful sequence of operation worked out to increase load factor and reduce operating costs. Result: This mill is now operating, paying good wages, satisfying stockholders, and the Power Company still has a customer.

In most dairy plants there is a relatively heavy refrigeration load of short duration. Savings often may be effected

by installing a storage refrigeration system to take care of this peak.

Occasionally, and perhaps too often, it is found necessary to justify the demand charge. There are many methods of accomplishing this both technical and otherwise. An example of a homely method was brought to the speaker's attention recently. As a result of an extremely low load factor at a shipyard the demand charge was a sizeable portion of the total bill.

The customer registered a complaint and, of course, a Power Engineer took over. Upon arriving at the shipyard, the Power Engineer noticed a medium size power boat tied up at the pier. Upon inquiring, he found the boat to be the property of the owner of the ship yard, and for rent. Thereupon, the power engineer stated that he and several of his friends would like to rent the boat and would drop by some time and get it. The owner then explained that he would have to know a few days in advance in order to make arrangements, to which the power engineer replied that it would be impossible to anticipate when the boat would be desired but that they would just come down and use it whenever they wanted it, explaining that it would be necessary for the owner to keep it available for their use. After a short conversation along this line the owner of the ship yard suddenly exclaimed, "Now I see why you have a demand charge in my rate for electric service. Your Company maintains this electric service for me at all times. In like manner, if I kept this boat ready for your use I would have to collect a demand charge."

In order to properly coordinate sales efforts, new business departments make surveys to determine, among other things, where the market is and what can be sold.

Most utility sales departments keep on file a classified list of prospects which is revised periodically. Figure 1 is a classification often used. This shows the prospects divided into three classes.

No attempt has been made to list all kinds of industries or types of prospects; however, it will serve for the purpose of this paper.

The last classification includes some industries having both waste heat and by-product fuel, such as pulp mills and gas manufacturing; also some having use for steam, hot water, or both, in process, as well as having available waste heat, by-product fuel or both. A pulp and paper mill is a good example of the latter.

***First,* those prospects using purchased fuel and having no use for steam or hot water except that occasioned by normal building heating, such as—**

- Coal piers
- Cotton gins
- Ice and cold storage
- Machine shops
- Mining, quarrying
- Pipe line pumping
- Plain goods yarn mills
- Sand and gravel washing and grading
- Street lighting
- Stone cutting
- Water and sewerage pumping
- Wholesale and retail establishments

***Second,* those prospects using purchased fuel and having use for process steam, hot water, or both, such as—**

- Abattoirs
- Bleacheries
- Breweries
- Candy manufacturing
- Garment manufacturing
- Heavy chemicals and drugs
- Hotels and restaurants
- Laundries, cleaners, and dyers
- Paper products
- Some textile plants
- Tobacco products
- Wool scouring

***Third,* those prospects having available waste heat or by-product fuel, such as—**

- Cement mills
- Gas manufacturing
- Iron and steel foundries
- Lumber mills
- Oil refining
- Peanut cleaning plants
- Pulp mills
- Woodworking mills

Fig. 1—Classification of Prospects

Generally speaking, the most likely prospects will be found under the first classification. Next in line will be those coming under the second classification; and those most difficult to obtain usually will be found in the third classification. Exceptions to this order will exist as a result of several factors, some of which are policies of the prospect, size, location, and personal likes and dislikes of the particular prospect.

Most industries have a strict policy requiring that all power plants pay out in from 3 to 5 years. Institutions of learning may feel the need of a power plant for instruction purposes. Some wish to have a power plant to play with or use as a show place and occasionally a prospect is found who *actually thinks he has a personal grudge against the particular utility.*

Regardless of any classification of prospects which may be made, extreme caution should be exercised in arriving at conclusions.

The fact that the industry does, or does not, have an apparently perfect heat balance, by-product fuel, or waste heat available, or use for process steam or hot water by no means should be taken as conclusive evidence in determining whether it is a potential customer.

At the end of the year a review of the new business obtained will more often than not show that it came from what at the first of the year were classed as "unlikely" as well as "likely" prospects.

The prospects coming under Class I should all become permanent, satisfied customers, and except for a few cases should be relatively easy to obtain.

If the power plant has not already been installed it is usually a fairly simple matter to obtain this business. However, with the power plant installed it is sometimes necessary to make a study to determine if it will be economical for the industry to make the change. One plant may have a very efficient mechanical drive, and present difficult and costly problems in motorizing, the other extreme would be a plant completely electrified, in which case the only cost would be that of connecting the service. All degrees of problems lie between these two extremes. The second group very likely contains the larger number of prospects that exist today, as it is quite probable that there are few left in Class I.

Many prospects under Class II at first may seem to present insurmountable problems, inasmuch as they all need process steam, hot water, or both; however, too hasty a conclusion should not be drawn, since it will be found that many can be obtained by looking beneath the surface. As an example—a superficial observation of the average laundry will reveal that, among other things, steam, hot water, and power are required.

Figure 2 shows a one line schematic diagram of the principal steam and water lines, together with the pertinent equipment in a laundry in which a recent study was conducted.

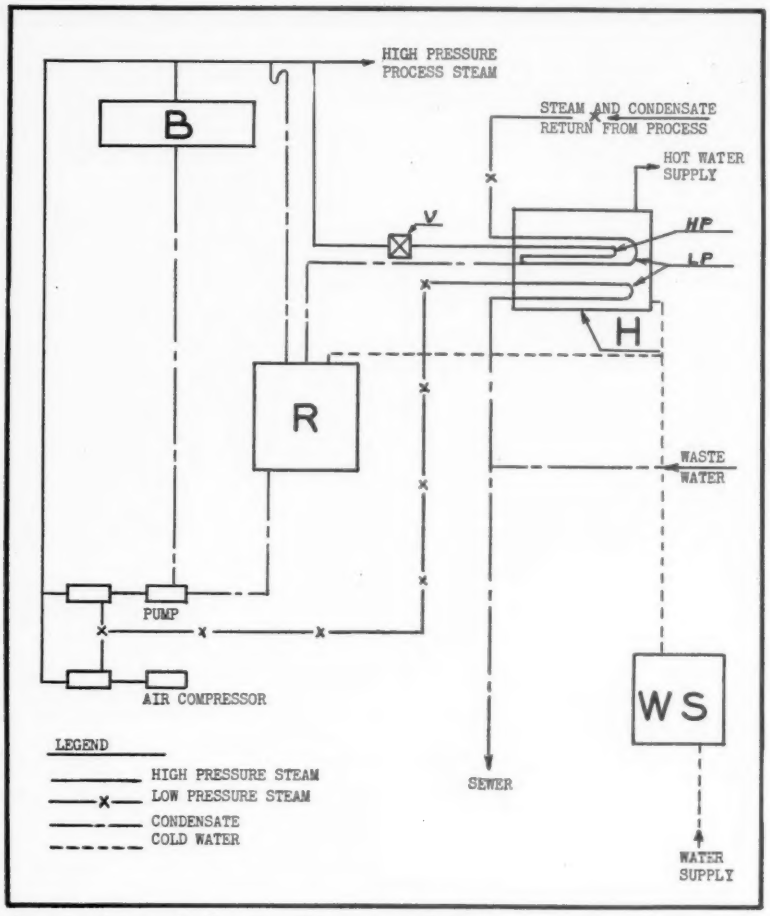


Fig. 2—Schematic One-line Diagram of Principal Steam and Water Lines in a Laundry

B represents the boiler
H the water heater
R the receiver
WS the water softener and
V a thermostatically controlled reducing valve.

It will be noted that certain condensate is passed through coil LP in the heater, and in addition live steam from the boiler is passed first through the reducing valve and then through coil HP in the water heater and used in producing hot water. The steam pressure on the boiler side of this valve was 115 lb. gauge, while on the other side it was 5 lb. gauge, and *here is the vulnerable spot* in the laundry, since it is apparent that some power can be generated incident to reducing the pressure of this steam.

Steam at boiler pressure was required for most of the steam heated equipment. Relatively, large quantities of water at 180° Fahrenheit were required for washing, and power to operate various equipment.

The owner of this particular laundry was asked by a steam engine salesman why he did not replace this reducing valve with an engine and make some free electric power. It was explained that an engine was available which, with the steam passed through this valve, would produce a large portion of the electric power required by the laundry, and perhaps all of it. Consequently, a study was made to determine the facts. At the outset it was apparent that it would be decidedly impractical for this laundry to produce power except during operating hours. Therefore, the study was made to determine whether the laundry could economically generate power during operating hours only and, purchase power at all other times. The total weekly power requirements approximated 3300 kwhr with a maximum demand of 80 kw determined as the highest average over a 30 minute period. Of the 3300 kwhr approximately 3000 were used during the operating hours.

This study disclosed that approximately 88,000 pounds of steam were passed through the reducing valve each week and used to heat water, the condensate being returned to the hot well to be used as boiler feed water. Quotations were obtained on an engine generator set installed complete with switchboard for $16,000 having a factory test guaranteed water rate of 40 pounds per kwhr net at the switchboard.

With the 88,000 pounds of steam available this engine should produce 2,200 or 2/3 of the required kwhr—but! don't forget that the use of hot water is going to control not only *how much* but *when* that power can be produced with that 88,000 pounds of steam.

Figure 3 shows at 15 minute intervals the high pressure steam required to heat the water, also the additional steam that would be required to produce the corresponding power used during two average days, Wednesday and Thursday. From this it is evident that these two demands do not parallel. It was found that in addition to the 88,000 pounds of steam passed through the reducing valve each week and used to heat water, 40,000 pounds, or 45% more steam, would be required to produce the power based on a water rate of 40 pounds per kwhr. Since, due to possible contamination, the condensate from this engine could not be returned to the receiver as before and used as boiler feed water, it was found that an additional 1500 pounds of coal would be required per week to make up this heat loss. In a laundry a considerable amount of live steam is used that comes in direct contact with the materials either washed, dyed, or cleaned, and great care must be exercised to eliminate all possible sources of contamination. Further still, the steam after passing through the engine will contain less heat value than when passed through the reducing valve, also some will condense, some will be lost.

The final results of this study indicated that an additional 44,000 pounds of steam at 115 pounds gauge, or a total of 132,000 pounds would be required each week to produce the power and hot water requirements.

Figure 4 contains a tabulation of the comparative costs found as a result of this study. It will be noted that the investments and charges included under private generation do not provide for miscellaneous supplies, treating of additional boiler feed water, additional labor, or any power relay. Further still, an engine water rate of 40 pounds net kwhr was used regardless of load. Even so,

it will take 27 years for the engine to pay out.

One thing more—did it ever occur to you that all the hot water with all its b.t.u.'s from the washing machines is usually emptied into the sewer? This was the case in this laundry. It was also noted that not all of the exhaust steam from the boiler feed pump and air compressor condensed when passed through the water heater. For about $4,000 two heat exchangers were installed, one in the exhaust line between the compressor and boiler feed pump and the water heater, the other in the hot water waste line from the washing machines indicated respectively as XI and X on Fig 5. The result being that nearly enough heat was recovered to replace that supplied from the live steam *which was to have been used by the engine salesman to* MAKE POWER.

Chemical plants have relatively large uses for process steam at low pressures. A good example is a plant which recovers nicotine from tobacco. A recent case of this kind involved one purchasing electric service for the operation of one unit of its plant, the other unit being mechanically driven by a steam engine, the exhaust from which was used in process. A study disclosed that the heat in the exhaust from the engine could be replaced by reclaiming it from another process. It was also found that relatively large amounts of power were lost through the use of long line shafts and numerous belts. The result being that the engine was shut down and power purchased. In addition several steam driven pumps and auxiliaries were replaced by electric drives.

Under woodworking will be found basket and veneer manufacturing plants, having both waste fuel and uses for process steam. Let's look at the record of one of these plants.

Here is a plant that manufactures all kinds of baskets, shooks, and containers from veneer for shipping fruit, and garden truck.

Large amounts of waste fuel were available and relatively large quantities of steam were required to steam the logs before placing them in the veneer lathes. Some power was purchased, but the greater portion was produced by an engine. The finished products were air dried. A study of this plant resulted in a steam heated conveyor type kiln being installed using steam at boiler pressure to replace the air dried system. Since this kiln together with steaming the logs required all the steam that was available from waste fuel, all power requirements were purchased, resulting in a decided reduction in the cost of the finished product after allowing for fixed charges on the new investment.

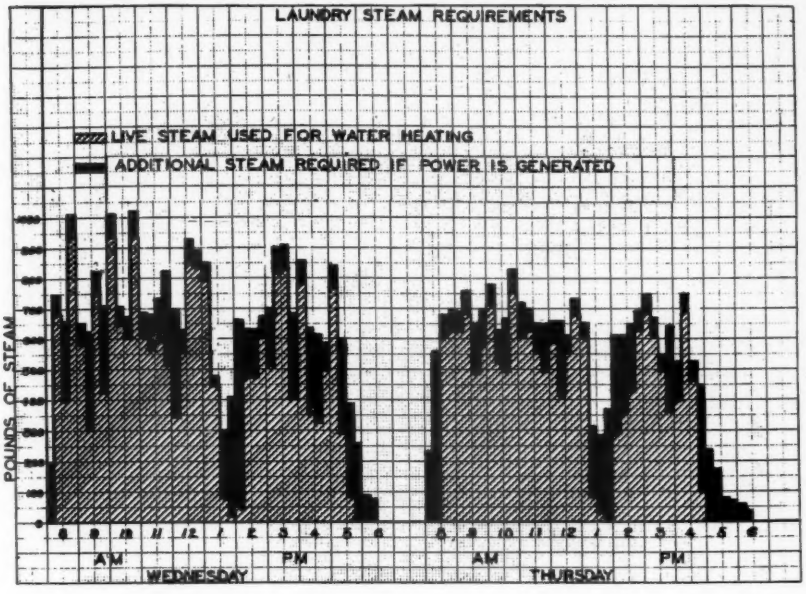


Fig. 3.

With the air drying system it took from 8 hours to several days to dry, compared to three-quarters of one hour in the new kiln. With the new equipment orders were filled on time, storage space materially reduced, and spoilage from mildew eliminated. This last item was of particular importance, since only 60 per cent of the air dried product was saleable.

Consideration was given to going to high pressure steam and producing all power as a by-product. However, inasmuch as the total power requirements were something less than 1000 kw and the operations were normally confined to one shift, or not in excess of 200 hours a month, it could not be justified.

There is still another case where an ice plant was being operated with a steam engine directly connected to the compressor and purchasing a small amount of power for lighting. In this plant the fuel was wood refuse, the only cost of which was transporting it from

PURCHASED UTILITY POWER
versus
PRIVATE POWER PLANT

Purchased Power (annual cost)		$3,224.00
Private Plant ($16,000 cost installed)		
Interest on $16,000 @ 4%	$640.00	
Taxes and Ins. on $16,000 @ 2%	320.00	
Using a water rate of 40 lb. regardless of load additional coal @ $4.70 per T.	743.60	
Additional water @ 5c. per 100 C. F.	50.96	
Purchased Power	720.20	
Maintenance ($1.00 per HP year)	150.00	
Total		$2,624.76
Annual Amount Available to pay for plant		$599.24

Private Plant will pay out in
27 YEARS

Fig. 4—Cost Comparison.

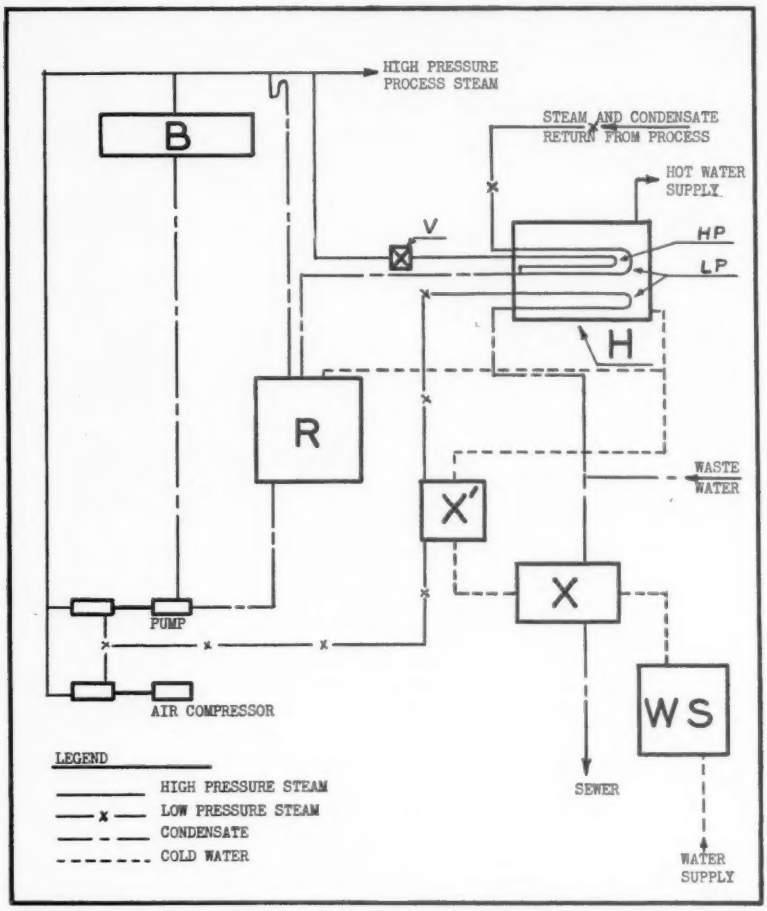


Fig. 5—Schematic One-Line Diagram of Principal Steam and Water Lines in a Laundry after installation of Heat Exchangers.

a nearby lumber mill. From a casual observation one would conclude that no saving could be made by purchasing power. However, a careful study disclosed that the cost of transporting and burning the fuel, together with the boiler maintenance, and necessary labor, would pay the fixed charges on the cost of electrification, the power bill, and leave a profit for the owner of the ice plant. Result! This ice plant was completely electrified.

Class III also contains business which can be obtained. As an example, the construction of a relatively large insulating board mill was being considered which would use a relatively large amount of steam in drying and have available waste fuel. However, a careful study indicated that a power plant could not be justified even though the operation would be continuous day and night. Consideration was given to three arrangements:

1. to manufacture all power and steam requirements;

2. to operate in parallel with the utility manufacturing such power as could be produced with a back pressure turbine operating at high pressure steam; and

3. to purchase all power—the last of which proved decidedly the most economical arrangement.

Time will not permit consideration of commercial customers such as large apartment houses, office buildings, banks, hotels, and restaurants, other than to state that a power plant seldom can be justified and with the modern and improved methods available for electric cooking, it is usually a simple matter to completely electrify all such establishments.

Earlier in this paper it was mentioned that among other things utility service is clean, convenient, flexible, noiseless, reliable and finally economical. The actual proof of this statement lies in the fact that most electric service is supplied by privately owned utilities, which in the final analysis is the best indication that steam competition can be met successfully.

In conclusion, attention is directed to the following points in meeting steam competition or converting prospects into permanent and satisfied customers. Study carefully the personality of the prospect. Know the facts. Sell yourself first. Avoid arguments. Let the customer find the answers. Be a good listener and use his ideas. "It is what the customer *thinks* that counts." Look beneath the surface. Don't let a little steam and hot water blind you to the real facts. Don't let waste fuel or by-product heat scare you, and finally, remember that it is only 5 per cent engineering, and 95 per cent salesmanship.

Nebraska Rural Cooperatives Having Difficulties

THROUGH the operation of the state law which requires the filing of the financial returns of rural cooperatives, there have been made available the 1939 accounts of certain public power projects in Nebraska. Of these, twelve have been in operation for the better part of 1939 and their combined income statement is shown below: Apparently the eleven of these enterprises (i.e., excluding the North Loup District) are about 80 per cent completed and according to REA news releases they would, when complete, consist of 3,707 miles of line and have 9,292 customers—or only 2½ customers per mile of line.

As might be expected from this low customer density, evidences of a struggle against economic difficulties are apparent. Excluding the North Loup Public Power District, the revenues of the eleven reported projects operating in 1939 were only 8 per cent of the value of completed plant (as compared with about 20 per cent for the usual electric enterprise). Neither taxes nor depreciation appear in the income statements and in only one case would net income have been sufficient to cover either of them if they had been shown. Only one company was able to apply any net income to the retirement of bonds. The following observation is typical:

"From results obtained to date it is evident that additional members must be added to the existing lines together with an increased consumption of energy by the present users in order that the project may show a cash surplus sufficient to amortize its long term debt." (Report of REA field auditor F. M. Helring, upon the Burt County, Nebraska, Rural Public Power District).

Improve Your Industrial Sales Methods to Increase the Net Income of Your Company

By W. A. Moore

Vice-President, Mississippi Power & Light Company, Jackson, Mississippi

An address presented before the National Power Sales Conference, Roanoke, Va., April 25 and 26

THE papers that have been presented at this National Power Sales Conference of the Edison Electric Institute and Southeastern Electric Exchange show that there is an appreciation of the seriousness of the problems ahead of the private utilities and the need for planned and aggressive—and may we add—improved selling to solve these problems, in the Industrial Sales end of the business.

Have we really got what it takes to do the job?

These problems present a real challenge to all of us here in this room. The need for improved selling goes further, it presents a personal challenge for us to improve our knowledge, breadth of vision, judgment, sales ability and effectiveness.

The solution of these problems will be difficult. You will find it will require among other things the following:

1. An open mind to new ideas, methods, etc.
2. Market Research—knowledge of the customer's business, new applications and possibilities for future growth.
3. Job Analysis—A study of objectives and approach.
4. Knowledge of *our* product—Modern Electric Service—and a keener appreciation of its true worth—its Value and Cheapness.
5. An improved technique of selling—this is of major importance and the one which I want to talk about.

Obviously time will not permit us to discuss this in detail, however, since this is a fact finding age and progressive business men demand facts prior to formulating conclusions, I would like to present a few facts and fundamentals that encourage us in our belief that a new sales technique must be used.

Utility Industrial Service Is a Valuable Service

Industrial sales are important to utilities providing this class of business is compensatory. This is emphasized by the fact that well over one-third of Total Electric General Business Revenues of utilities is accounted for by Industrial customers.

The desirability of building up compensatory Industrial loads becomes doubly clear when attention is given not only to the size of the revenues they afford, but also to their favorable inherent characteristics as a means of improving utility system load factors, thus making possible lower and more promotional rates for all classes of customers.

Among ourselves we agree that utility industrial service is a *desirable* and, therefore, a *valuable* service from the customer's viewpoint. Its use is insurance for the customer against a formidable array of losses, cares, troubles and difficulties. Its use is assurance for the customer of important benefits, advantages and savings.

Revenue from Industrial Sales Must Be Protected

The utility industrial revenue is more vulnerable to competition than any other portion of the utility market. This is particularly true of direct competition from sales organizations promoting the use of other forms of power. The flood of advertising and publicity material featuring the Diesel engine in the transportation field, plus "Packaged Power," tends to arouse the individual's desire to try something new or experiment. As our aggressive sales efforts result in increased utilization of utility service and improved load factor, our competitors are more anxious to secure the business.

While the development of new industries and applications present opportunities for increased sales of utility service, active sales promotion is necessary to combat load mortality. Changes in industry, such as the use of Nylon in place of silk, plastics replacing metal and wood, and others, prove the vital necessity for protecting Industrial revenues. These constant changes in use of industrial service bring out the need for market analysis and knowledge of research activities as a means of safeguarding Industrial Revenue.

Closely allied with Industrial Development is the migration of industry. This migration has in the past been due to such things as change in raw material costs and requirements, new markets, labor, taxes, etc. What is one utility's loss may be another's gain. Unfortunately, competition between utilities for a new industry introduces elements that limit the possibilities of profitable revenue. New industrial business should only be solicited on a compensatory basis. Since the cost of electric service is such a small percentage of manufacturing cost and should not reflect in the choice of location, competition between utilities seems unnecessary.

Industrial sales are exceedingly prompt in their response to the ebb and flow of economic tides. A sound basic sales plan will enable the utilities to meet such changes as they arise, and protect the utilities' industrial revenue.

The most important reason for protecting Industrial Revenue is to maintain *Profits*—Utilities cannot continue in business if there are no *Profits*. Profits are the incentive to investment. Additional sales efforts precede the need for additional investments. Most of you are familiar with the difficulties experienced in raising new capital for the electric utility industry. Past records and forecasts show clearly that the present trend in restriction of return on capital investments must be reversed and that "Plus Dollars" of Net Income are vitally needed.

The records show—for seven year periods based on "average expenditures for new construction" and "average additional revenues" per additional kilowatt hour sold:

Period	*Expenditures*	*Revenues*	*Ratio*	*Operating Ratio at End of Period*	*% Return for New Money and Depreciation*
'23 - '29	10.41¢	2.35¢	4.5/1	48.0%	11.5%
'30 - '36	10.85¢	0.83¢	13.0/1	51.5%	3.7%
'37 - '43	11.30¢	0.52¢	21.8/1	55.0%	1.9%

How frequently do we sell increment service at a price without Profit? We really need to sell selectively large increases of *USE* at good load factors to improve our net revenues.

Personal Opinions of Industrial Customers and Utiiities Must Be Changed

Few of our present prospective customers have operated isolated power plants and, therefore, lack in the appreciation of the value of purchased electric service gained through experience. Customers who have operated isolated power plants are willing to pay more for our services than those using purchased electric service only.

Similarly few of our Industrial salesmen are thoroughly familiar with the difficulties and disadvantages inherently associated with private plant operation. Industrial salesmen are frequently too conservative in evaluating the advantages and savings of purchased electric service. The salesman must have imagination enough to visualize these advantages plus necessary facts for properly evaluating them. Our sales training for improved selling should be planned to create this imagination and the proper evaluation of these facts.

The desire to experiment—the conviction that success can be attained where others have failed—frequently results in large customer investments in private power plants. Past performance has influenced utilities in their evaluation of certain types of Industrial manufacturing businesses such as cement, woodworking, steel, hosiery, etc. Under present business conditions, these evaluations change overnight. New processes emerging from research laboratories, economic factors as affected by Business Cycles, War, Politics, etc., changes in equipment design and efficiencies, are among the many reasons for these changes or mortality of business. Many of us must change our evaluations, particularly of certain seasonal business, or others where the annual revenue in dollars per kw year is too low.

It is the function of the Industrial Sales Department to anticipate changes and with adequate information be in a favorable position to influence customer thinking.

"Know Your Customer" to Improve Net Revenue!

We know their requirements, their buying habits, their buying motives, their use of the service, etc. Do we know the customer's business well enough to approve the expenditure of large amounts for facilities to serve their power requirements?

How many of us have considered that every time our company invested money in facilities to serve a customer it was in reality becoming a common stockholder in the customer's business? Sell this partnership responsibility for mutual profit.

A study by Dun & Bradstreet indicates that 34.2 per cent of business failures result from "lack of capital" while 33.7 per cent are due to "incompetence." Both of these are in reality "incompetence" because a person who enters business with too little capital or permits his ready cash to become depleted, generally does so through ignorance.

Should we permit the incompetence of our customers to limit our possibilities of improving net revenue?

Could we be criticized for disposing of unsound and unprofitable business when chance affords?

Should we take *long time investments* to serve *short term loads?*

Of course, the success of an investment depends ultimately upon future developments, and the future may never be forecast with accuracy. But if you have precise information as to a company's present financial position and its past earning record, you are better equipped to gauge its future possibilities and the risk involved.

All of this indicates that we must know our customers better than ever before. We must be analysts, economists, lawyers, bankers, have good business judgment, a knowledge of human relations and, of course, most important of all be good salesmen. Having these abilities and the required fundamental knowledge of our customer's industry and business will enable us to improve our net income by selective selling.

Market research provides a valuable tool for securing information about basic trends of industry and their effect on a utility's system, revenue and potential market. It can also furnish data about competition and future possibilities that may come about as a result of technological development, new utilization equipment or new applications.

An article "How Does Your Business Face the Future?" by Ford, Bacon & Davis, Inc., shows clearly by means of charts the ebb and flow of trends. Examples are the decline in piano sales compared to the rapid improvement in radio market and the sharp increase in rayon production contrasted to gradual decline in silk production.

Other examples are the developments in plastics, metals, synthetic rubber and glass—all having a definite bearing on the sale of electric service.

Comprehensive knowledge of operating conditions and cost permits the proper evaluation of comparative advantages of purchased electric service. How many times have you heard a customer say "Electric Service is Convenient" or "Electric Service has Increased my Production."

Other impressive advantages of Purchased Electric Service are:

Dependability
Flexibility
Economy
Safety
Reduced capital investment
Expansion with minimum added investment
Simplified accounting
Release of supervisory time

The dollar value of these advantages and the value and cheapness of utility industrial service must be made clear to the customer. Methods of evaluating advantages and securing customer's recognition and admission of such values must be a part of the Industrial Sales Plan and Approach.

Before a manufacturer will make an expenditure for new equipment in his plant, he accurately determines what savings or earnings will be effected. A summary of replies to a questionnaire sent to 800 representative manufacturers by a government Unemployment Committee shows that 97.4 per cent of firms reporting required from one-half to 4½ years for new equipment cost to be amortized. Sound business policy, therefore, dictates that no industrial investments be made unless they can be amortized rapidly. It appears only logical that an equivalent write-off policy should be applied by the customer when purchasing power generating equipment rather than basing the amortization on the physical life of equipment.

Information and statistics concerning the functional life of power generation equipment will be helpful in selling the need for setting up adequate fixed charges and providing for quick write-off in written sales presentations. Naturally it is advantageous and more effective to secure customer's acceptance to a quick "write-off" policy at some time other than in the active stages of an important sales negotiation.

There are magnificent Industrial plants, some unused, that stand now only as a monument to architectural skill. Here entire investments have

been "written off." They are excellent examples to prove the advisability of quick "write-off." Economic conditions brought about by the European War dictate the establishment of a safe *"write-off"* policy.

Competition Knocks at the Door of the Utility Industrial Customer

Every customer we serve faces competition in a market that is never static. He is confronted with the necessity of market research and analysis, new processes changes and the other uncertainties previously mentioned. He also must compete with other industries that are striving for the purchaser's dollar. If it were not for competition the percentage of failures listed above would naturally be lower. It is our responsibility to know the customer well enough to determine closely the risk involved in making an investment to serve his plant. Accurate records available from Dun & Bradstreet show that the average life of all industries is only 7 years. Many industries face liquidation in far shorter time. Here again we have indicated a measure for determining the "write-off" period for competitive power equipment in specific industries.

Not only must we know the customer's competition but also the possibilities of competition from the installation of private power plants. The ability to generate power from process steam or other favorable conditions may place the competitive value of purchased power so low that the business could not be secured on a compensatory basis. In view of utility industry earning statistics there could be little gained by selling this class of service even on an incremental basis. If on the other hand dependability or continuity of service is such that isolated plant requirements would far exceed the cost of purchased electric service, we should not fail to bring this to the customer's attention and secure his acceptance of these values. Perhaps at a later date operating conditions may change and the savings made possible through purchased electric service or the values established for comparative advantages will facilitate securing new contracts.

Sell Modernization to Increase Net Revenue

Modernization of equipment with improved efficiencies may tend to lower power requirements. Here the alert and aggressive salesman, fortified with a knowledge of the customer's business and conditions, should work out plans for increased sales and production. This would result in "plus dollars" of revenue rather than loss of revenue, or additional usage for same revenue.

A modernization survey should be made and kept up-to-date. This should be done in cooperation with manufacturers and other sales allies. In addition to improved applications for electric service, adequate wiring and other improvements in equipment and new processes should be included. Modernization is one of the best means by which industry can meet the ever increasing number of uncontrollable costs and contend with such factors as shorter hours, higher wages, increased taxes, keen competition, and regulations.

Money invested in modernization of plant facilities will return far in excess of any possible savings in power plant equipment. Then, too, money spent for plant modernization rather than power generating equipment minimizes the possibilities of competition. Find other advantageous uses for customer's extra working capital or available cash in order to maintain utility earnings and to secure "plus dollars" of revenue. Selective Modernization can best be sold to business men by showing the added profits which it makes available.

Help Solve Your Customer's Problems

The basic duties of the Industrial Salesman are to hold present compensatory business, obtain profitable new business, and to develop good customer relations. It is necessary for the salesman to concentrate his time and efforts upon specific, aggressive, creative selling. This should include more than selling the use, value and cheapness of utility service. It should include helping the customer maintain and improve his operating and competitive position. This can be done by helping solve the customer's problems of labor, material, production and sales.

The Time to Act Is Now!

The best way to forestall competition and to secure new profitable business is to use modern sales methods and execute aggressive and positive selling programs. Because of the inherent nature of the utility business, it is impossible to renew the present downward trend of earnings overnight. Therefore, if we are to improve net income for the future, it is imperative that definite action be taken now.

Summarizing

—Interest in the utility balance sheet is evidenced in many papers presented here at the Conference.

—Industrial Service representing over one-third of utility revenue and solving the many customer problems is a valuable service.

—Trends of Industry, new processes and applications, economic factors and others necessitate the protection of industrial revenues.

—Personal opinions of industrial customers and utilities must be changed to secure proper evaluation of the advantages of purchased electric service and industrial business.

—Present day selling requires a full knowledge of the customer's industry and business. This knowledge permits the proper evaluation of comparative advantages and the selling of industrial service on a compensatory basis.

—We exist by the customer's desire and willingness to do business with us. To create this desire we must know our customer and our company well enough to intelligently organize a set of facts and effectively present them.

—THE TIME TO DO IT IS NOW—

Interior Wiring Handbook To Be Revised

The nationally accepted Handbook of Interior Wiring Design is to be completely revised during the current year, it has been announced by Mr. E. A. Brand, Buffalo Niagara and Eastern Power Corporation, who is chairman of the Industry Committee on Interior Wiring Design. The revision will take into account advances made in wiring design practice since 1937, as well as the changes in basic design made necessary by important revisions embodied in the 1940 edition of the National Electrical Code.

The work of revision will be handled by a technical subcommittee of which Mr. R. G. Slauer, Westinghouse Electric and Manufacturing Company, is chairman. Members are: Mr. A. B. Smith, National Electrical Manufacturers Association; Mr. Allan Coggeshall, Hatzal and Buehler; Mr. M. S. McNaught, Electrical Contracting Company; Mr. G. S. Merrill, General Electric Company; Mr. F. N. M. Squires, New York Board of Fire Underwriters; Mr. Howard Stevenson, Detroit Edison Company; and Mr. W. S. Stewman, New York Power and Light Corporation.

Mr. Slauer will appreciate suggestions and comments regarding the Handbook text, material covered and method of presentation. He may be addressed at Westinghouse Electric and Manufacturing Company, 150 Broadway, New York.

Selling Industrial Lighting

Lighting Sales Offer Opportunities for Complete Plant Electrification

By Roy A. Palmer
Duke Power Company

A paper presented before National Power Sales Conference, Hotel Roanoke, Roanoke, Va., April 25, 1940

FOR over twenty years there has been conducted an aggressive educational campaign directed to industrial executives outlining the advantages of better lighting. In the early days of this campaign, there was not much factual proof to substantiate statements which appeared in trade journals, articles, advertisements, sales promotional literature and other media. Illuminating engineers and others close to the lighting business were convinced beyond question that the statements they made regarding increased production, lower labor turnover, fewer accidents, less spoilage and other benefits of better lighting were founded on a sound basis. However, the industrial executive had to accept these claims on the basis of faith because of the lack of supporting evidence. As we look back to industrial lighting activity in those days, we can recall the several exhaustive tests which were conducted in industrial plants by various unbiased organizations to prove that better lighting would increase production. Close track was kept of production under existing lighting and with all the variables eliminated as far as possible, compared with production when improved lighting was provided for the same work. These tests substantiated to a large extent these claims.

However, even in the face of these valuable data, industrial lighting progressed at a relatively slow pace. We needed something more in the way of sales ammunition and data with which to convince the industrial executive that better lighting in his plant would be a part of his production tools the same as modern machines and equipment.

As years have gone on, several things have been brought about which have contributed enormously toward a greater acceptance of the benefits which better lighting will bring. Several years ago, the Science of Seeing was brought out of the laboratory with indisputable and convincing data showing that the process of seeing was dependent upon several factors, among which the quantity and quality of lighting were extremely important.

The advent of the light meter gave us an instrument by which the layman could himself measure the illumination at any point. This meter provided the link which was heretofore missing in the lighting story. The fact that the human eye is in itself a poor judge of the amount of light present made it extremely difficult, even with all the facts available to convince an industrial executive or anybody else that the illumination was insufficient. The light meter perhaps was one of the most valuable contributions toward enabling us to tie in effectively the Science of Seeing story and thereby convince the customer that better lighting was absolutely necessary to supplant the existing inadequate installation.

The Better Light-Better Sight movement was the logical outgrowth of the enormously valuable information which the Science of Seeing had made available. Even in the midst of the business depression the lighting business went forward. More lighting equipment was sold, more lamp bulbs manufactured and more kilowatt hours consumed, all because consumer acceptance had been built up for better lighting. The Better Light-Better Sight program interpreted the Science of Seeing laboratory data in laymen's terms. The light meter permitted the customer to see for himself the condition of illumination in his plant, store, office or home. We must not fail to give credit to the I.E.S. lamp in this program of education because by its adoption in millions of homes, school dormitories and other places, people generally became acquainted with the delightful comfort which quality footcandles could provide. It is a matter of record that industrial executives after having read their newspaper under the illumination from an I.E.S. lamp were sold on the idea that better lighting could be used to advantage in their plant.

Another contributory factor in this growth of acceptance for lighting standards on the part of the public is the constantly lower rates for kilowatthours. Because electricity costs less today, people are more willing to install more wattage and use lighting for longer hours. Unfortunately we still have a big selling job to do in convincing the public further that electricity is cheaper today than it ever has been in history. We still must continue to emphasize this fact at every opportunity. We should constantly be using every promotional resource possible to remind the public that electricity is the lowest-priced commodity on the market today.

More recently the introduction of the fluorescent lamp with its several advantages that have unusual appeal to the consumer is further contributing toward the acceptance of higher lighting standards. Perhaps the greatest interest that this lamp has aroused on the part of the public is the greater output for the wattage consumed. I am not sure but that this is another indication of our failure to sell the public on the idea that electricity is the lowest cost item in general use today. We have had a marvelous story to tell about lower cost of electricity but still salesmen had to wait for a new lamp to appear upon the market before they progressively and enthusiastically talked about lower lighting costs. The success of this new lamp, however, is opening up a new cycle in lighting practice and acceptance. At the present time it does not fit every lighting job and, therefore, should be specified only with knowledge and good judgment.

As a result of all these developments over the past several years, we now have an interest aroused in better light on the part of everyone. When we have store owners, office managers, home owners and others interested in lighting, this naturally contributes to a greater interest in the minds of industrial executives. We can say with assurance that today, as perhaps at no other time, we have a greater acceptance of better lighting. Is it not logical then that we should use industrial lighting sales as an entering

wedge in the industrial plant to assist in complete electrification of that plant? A discussion of lighting with the industrial executive will provide an entree to plants where before it has perhaps been difficult to get in. Moreover, when better lighting has been sold, there invariably has been built up a feeling of good-will. In all of my experience I have never found a lighting salesman who was accused by a customer for having oversold or high-pressured him into something that was not useful and beneficial. A salesman might have used some high pressure to sell the job, but because the place was so much more cheerful, the workers so pleased and other benefits so obvious that the investment, however large or small, was considered a practical and wise move.

A good many splendid lighting jobs have been sold in this country over the past several years. Those are the jobs we hear about and see written up in the trade journals, but, by and large, they are the exception. The majority of industrial plants are still far underlighted according to present-day standards. A trip through most any plant at random with a light meter will reveal that enormous improvement can be made. In fact, the lighting art is advancing so rapidly that even in the plants which we consider well lighted today, there are many opportunities for still greater improvement. In our company we have constantly pointed out to our lighting salesmen that as soon as a customer has been sold better lighting he is immediately a prospect for more lighting. There is always some place, even in the well-lighted plant, where additional footcandles and improved quality of illumination can be used.

We have the past experience, laboratory data and vast storehouses of information which show us that there is a need for improved lighting. Present-day living and working conditions impose a high tax upon the visual sense. Even where a worker is tending to an automatic machine, good illumination is necessary. It is often the opinion of the industrial executive that because a worker does not require to use his eyes constantly while working on an automatic machine, there is no need for a high level of illumination. However, when that machine does need attention that worker must be able to see quickly, distinctly and safely. The worker's eyes control not only the work done by him but the judgment of speed of machines, color of materials and quality of goods. It perhaps is quite unneccessary to mention here that the proficiency of a worker depends largely upon seeing conditions. Anyone informed on some of the fundamentals of the Science of Seeing can immediately appreciate the value of good seeing to any work.

In addition, we must not overlook the psychological aspects. Today's industrial executive is much more concerned about the employees' working conditions. He is interested in having his plant free from accidents and the general working conditions such that the employee is contented and happy. Good lighting contributes in every way. It guards against accidents because the speed with which a worker can see may prevent an accident. The atmosphere of the room will contribute to the employee's mental attitude. There is a plant in North Carolina which has enormous labor turnover in the night shift. When that work room was relighted, that labor turnover dwindled to a negligible percentage.

Lighting Paves Way to Power Sales

In the very great majority of cases when new lighting is sold a new wiring job is necessary. Very often this means re-arranging and installing new switchboards as well as new circuits, switches, etc. This in turn may involve circuits to motors and heating devices in the plant. The alert power salesman having an eye to such changes which may be necessary, then has an opportunity to suggest additional motors and heating equipment.

One can make a pretty safe bet that the existing wiring in a plant is loaded up to capacity. When new wiring is being installed for lighting, additional wiring can also be installed to take care of heating equipment which at the present time may be too small for the job to be done, but which perhaps has not been changed merely because the existing wiring cannot take it. To speak about such a situation may seem ridiculous, but there are no doubt several in this audience who know specifically of such cases. If we install wiring on the basis of voltage drop rather than ampere carrying capacity we will not only provide for immediate use, but also provide for reasonable future requirements and at the same time assure the consumer of maximum efficiency of the equipment.

In many plants, particularly the older ones, machines have been placed along the windows of the room to take advantage of daylight. There are thousands of plants today where the daylight conditions are not satisfactory and very often the placing of machines along windows handicaps the routine of the production line. With good artificial illumination, it is not necessary to locate the machines with respect to the availability of daylight. Therefore, the installation of lighting may permit the re-location of the machines throughout the room. When such a change is made, obviously there are plenty of opportunities to suggest the elimination of line belts and the installation of individually motorized machines. I recall one plant where so much space was wasted because of the location of machines near windows that production was seriously handicapped. The better utilization of the space formerly wasted in the center of the room after a modern lighting system was installed brought that plant out of the red and saved them from imminent bankruptcy.

While the power salesman is talking lighting to the industrial prospect, he is in effect a lighting and seeing specialist. If he does a good job by showing that he has the good knowledge of his subject, he can build up confidence with his prospect. Being thoroughly familiar with the various types of lamps on the market, he can perhaps suggest savings to his customer by using the proper lamp for the job. This leads to an opportunity to suggest new lamps for old jobs. The new infra-red lamps or drying lamps as they are popularly called, have many applications which they can perform to better advantage than present methods and are an excellent load builder. The low cost of electrical service permits these lamps to be used with economic advantage to the industrial executive. These lamps are new and, therefore, fit into a power salesman's kit of industrial tools and especially when he has sold himself as a competent lighting specialist to his prospect.

Power Salesmen Can Be Lighting Specialists

Of course, when selling lighting the more a salesman can know about the subject the better and quicker he can convince his prospect. However, the power salesman should not feel that he must be an illuminating engineer in order to sell lighting. If he acquaints himself with the fundamentals of light and the Science of Seeing, together with a fair knowledge of lighting equipment, he will be able to do a very creditable job. The excellent bulletins provided by the lamp and lighting equipment manufacturers are full of helpful infor-

mation which with a little study and discussion with lighting representatives will give the salesman a background so that he can make a good presentation. It is imperative that every salesman who is selling lighting be equipped with a light meter. For those who wish to go into the matter more deeply a visibility meter and the brightness meter are valuable assets.

When selling lighting, salesmen should constantly keep in mind that the prospect is not so much interested in purchasing lighting equipment, lamps, wiring and other materials that make up the lighting system, but he is infinitely more interested in purchasing *the results* which the lighting system can produce. The industrial executive may think that the illumination in his plant is sufficient or perhaps he may say, that there is even "too much" light. A check with the light meter may reveal that there are only five footcandles or even less in that plant, but the existence of bare bulbs creates so much glare that the impression is gained that there is too much light. We must remember that outdoors we get 1000 to 10,000 footcandles and the very best of artificial lighting installations today provide only 50 to 100 footcandles. We are still obviously far from levels provided by daylight. We can deduce from this that good lighting must have two things—high levels and low brightness.

Artificial light must be controlled the same as we must control daylight. Many industrialists go to the expense of putting large window areas and skylights in buildings only to find that the brightness is so high at certain times of the day that it must be controlled by curtains, awnings or blinds, all of which are perishable and difficult to handle, as well as an item of expense that must be chargeable to daylight illumination. Very often to overcome these objections windows are painted which causes possibly 90 per cent or more absorption of the light. When dark days come, daylight in the plant then is not of much value.

To control artificial light, we place the bulb in lighting equipment which is designed to keep the brightness low and also to distribute the light properly over the area to be illuminated. A poorly designed fixture may fail in both of these qualifications. However, the standard RLM Dome reflector and the Glassteel diffuser are still the important equipment for general lighting in a plant. This reflecting equipment has proved its usefulness in a large variety of applications during the last 20 years. They are relatively inexpensive to install, are efficient and good in appearance. For specific jobs requiring lighting applications, other equipment is available which is designed from the standpoint of special distribution or a particular color quality of light. It is in these special applications where perhaps the new fluorescent lamps have particular usefulness such as for inspection work, color discrimination and illumination of local areas.

While it is desirable for the power salesmen to be as well informed on lighting design as possible, it is not necessary that he be a highly specialized expert. Almost every power company has men who are well equipped with lighting information and the power salesman can depend upon such men for assistance. Cooperation in such cases is not only highly desirable, but mutually helpful. If the power salesman knows that for general lighting the lighting units should be spaced no farther apart than they are mounted from the floor to provide uniform illumination, it will assist them in quickly making an estimate of the number of outlets and units required. In the average industrial plant, such spacing and mounting will provide good illumination when the units are equipped with 500-watt lamps. Whether or not 500-watt lamps are used initially the outlets should be wired for that capacity, because sooner or later there will be a demand for higher illumination.

In reviewing the opportunities which exist for the power salesmen it seems that lighting presents one of the most lucrative opportunities for entree to the industrial plant. The interest among all industrial men in lighting is at a high pitch. Never before have we witnessed such an acceptance on the part of any consumer group. In addition, one can build good-will with a lighting sale perhaps better than with any other type of electric service. Probably this is because improved lighting has so many benefits that are obvious to everyone in the plant. The buoyant atmosphere provided by the better lighting has a marvelous psychological effect. With the toe-hold gained through lighting sales, the door is opened not only for observation as to further power requirements, but since the spirit of plant improvement has already been generated, the sales resistance is also lowered. Every alert and aggressive power salesman will recognize his own opportunities among his customers. Those opportunities are golden ones not alone to his own individual benefit, but to the benefit of the electrical industry as a whole, and above all, to the customer who has been sold greater electric service.

Reddy Kilowatt's New Book on Plus Advantages

REDDY KILOWATT, the dynamic little figure created by Ashton B. Collins, has recently published a new book, "33 Plus Advantages of Reddy Kilowatt Power." Intended to serve as a manual for the advertising and sales promotion of central station power, the book features 33 selling points or "plus advantages" which have been used successfully by power companies in various parts of the country.

These are elaborated by excerpts from 186 entries and prize-winning papers in the industry-wide Customer Benefits Contest which Reddy conducted in 1939. It was in that year that Reddy entered the field of industrial and commercial power sales, thus capping a career in the residential service field which has already made his name and likeness familiar to electric companies, dealers, and customers in 44 states and several foreign countries. The contest received wide response, papers being submitted by power engineers in all parts of the United States and in other countries.

Copies of "33 Plus Advantages" may be obtained from Reddy Kilowatt, First National Building, Birmingham, Ala. They are priced at $1.50 per copy.

The term, "Reddy Kilowatt Power," has been registered as a trade-name for use in place of "central station power" or "purchased power" by companies subscribing to the Reddy Kilowatt service.

Companies which have recently adopted the new promotional program and are featuring the term Reddy Kilowatt power include:

Buffalo, Niagara and Eastern Power Corporation
Philadelphia Electric Company
New York State Electric and Gas Company
Pennsylvania Power and Light Company
West Penn Power Company
Carolina Power and Light Company
Minnesota Power and Light Company
Alabama Power Company

The Fluorescent Lighting Situation

By M. N. Waterman

Central Hudson Gas & Electric Co., Poughkeepsie, N. Y.

An address presented before the National Power Sales Conference, Roanoke, Va., April 25 and 26

ATTENTION! Gentlemen, we are about to fight a whole war in 20 minutes! Seriously—it seems inevitable that I should think of a war analogy when the title "The Fluorescent Lighting Situation" was suggested for this talk. In a few respects, at least, any talk about the fluorescent lighting situation will sound like a report from the western front or along the Norwegian coast. You know there has been a kind of war going on for the past two years in the supposedly neutral territory of lighting promotion. This war has produced great clouds of smoke and, of course, where there is smoke, there is at least a little fire.

Major action has been preceded by a mass of propaganda and there have been a considerable number of surprise bombs dropped from clear skies. Characteristic of the whole conflict has been a tremendous amount of noise with a great deal of confusion and war hysteria. One of the greatest difficulties has been the prevalence of inadequately trained and undisciplined troops in the field. The sad part of all this is that this war should have been entirely a major offensive against the common enemy of darkness. However, to date, much too much of the commotion has been a kind of civil strife between the leading armies. Fortunately, for the electrical industry, however, there are already a number of bright spots on the horizon. I suppose this is quite natural in a lighting war. For example, the diplomatic corps of the major armies have been doing heroic work. Unlike the world's diplomatic situation, there has been in fluorescent lighting a lot of frank discussion, some give and take. This has led to clarification of broad policies and gives a glimmer of hope that ammunition and manpower, until now wasted in confusion, may be directed toward the common objective of getting more business.

I shall now speak briefly about the position of central stations in this diplomatic work. Our diplomatic efforts culminated in an all-industry conference on fluorescent lighting which was held about a month ago as a special session of the annual E.E.I. Sales Conference at Chicago. At this meeting, the position of the utilities was definitely expressed in a resolution developed by the Lighting Sales Committee and unanimously adopted by the General Sales Committee. I know it is dangerous to abstract a document such as this but time requires that I do it. The full text of the resolution and a discussion of it is given in a recent E.E.I. publication to which I shall refer later. I do want to emphasize two parts of the resolution.

After an explanation of background, the resolution states that it will be the policy of the General Sales Committee of Edison Electric Institute to encourage every sound technical development in lighting sources and the art of their application in those fields where a better service can be rendered in accordance with the broad, established Better Light-Better Sight principles, with emphasis on freedom from glare, proper levels of illumination and the best interests of the customer. Notice that there is no holding back here. The Sales Committee states as a policy the encouragement of every sound technical development in lighting sources. The resolution goes on to state that it will be the policy of the General Sales Committee to promote only such lighting equipment as will provide good power factor (90 per cent or more), thereby protecting the wiring capacities of consumer installations. Notice again that the policy takes a very definite stand for high power factor equipment because the use of this equipment is ultimately in the interests of the consumer.

It has been observed in many skirmishes in the field that there is a belief on the part of manufacturers, jobbers, electrical contractors, and customers that any adverse comment about fluorescent lighting on the part of utilities springs from a fear of load mortality. I can report from the front that in all our canvassing of utility opinion, we have never found a thoughtful utility interest which objects to fluorescent lighting because of fear of load loss. However, there is a widespread misunderstanding of the utilities' attitude. It is for this reason that I wish to emphasize some points made by Mr. Whitwell, when he represented the General Sales Committee as presiding officer at the industry conference on fluorescent lighting to which I have referred. Mr. Whitwell was discussing the resolution. He said, in substance, that the utilities object seriously to the tendency—at the moment quite apparent—on the part of too many salesmen for fluorescent equipment to warn purchasers that utility representatives will doubtless criticize fluorescent installations and that the underlying reason for such criticism is loss of revenue to the utility rather than a sincere desire to be helpful to customers.

Such methods tend to destroy the confidence of customers of the utility and cannot be tolerated by the utilities. Such methods leave only the alternative, at whatever expenditure of time and money may be necessary, of re-establishing customer confidence. Yet the time and money spent to this end could so much more profitably be expended in selling additional light. I think it is obvious that the solution to misunderstanding lies in close contact with customers and with other lighting sales agencies. There is need for reiteration both by word and by action of the fundamental utility policy of serving the customer's best interest. In further discussion of the resolution, Mr. Whitwell emphasized the fact that utilities are not opposed to any sound technical development, of which fluorescent is an example, even though reductions in revenue, which over the years may be substantial, are involved. Past experience has shown that the result of such development has always been progress resulting in ultimate increased use and increased revenue. Witness, for example, how the tremendous increases in efficiency of the domestic electric refrigerator has brought with it the use of so many additional refrigerators that the result has been beneficial to all concerned.

Another factor that has been dis-

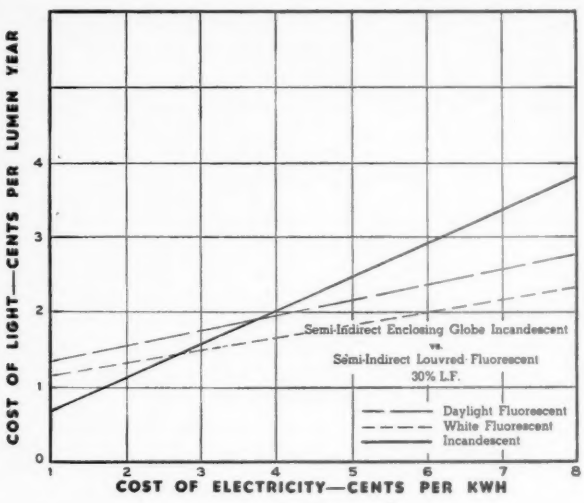


Chart 1

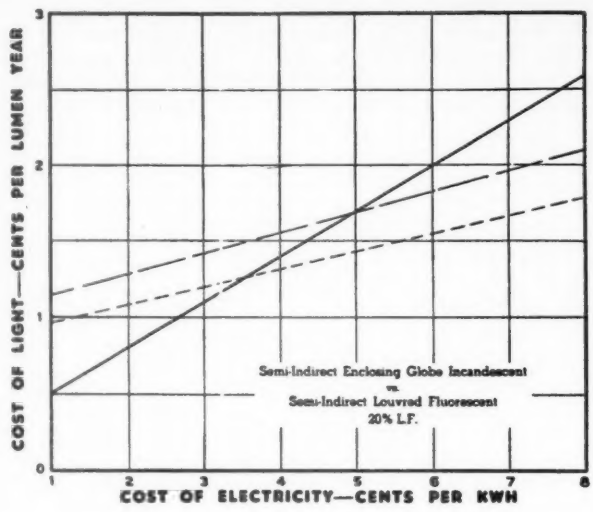


Chart 2

cernible amidst the smoke of the battle has been a tendency on the part of customers and others to assume that the cost of lighting is the electric bill alone. This, of course, is just like saying that the cost of power from an isolated private power plant is only the cost of fuel. Obviously, any sound study of cost must include the item of replacement of parts and the item of fixed charges on capital investment.

In mentioning the cost of lighting, I do not want to give the impression that lighting should be sold on the basis of cost alone. Cost is only one factor and is often a minor consideration. In factory inspection jobs, for instance, the lighting results may entirely overshadow the cost of producing the lighting. Nevertheless, costs are often a real concern and it is certainly desirable that the customer get figures which are the result of a sound method of computation. The Lighting Sales Committee of E.E.I. has suggested a standard method of cost comparison. Although this method possibly cannot be dignified by being called an "industry standard," it comes pretty close to that. It has received wide approval from utility lighting interests and has also been endorsed by representatives of the major lamp companies.

The cost comparison method is completely set forth in the report "Recent Developments in Fluorescent Lighting," which was distributed last December. In addition to the cost method you will find other interesting data about fluorescent lighting. The report entitled "Industry Conference on Fluorescent Lighting" was issued about ten days ago. It contains the General Sales Committee's resolution and a report of the discussion at the conference.

Charts 1 to 4 will show how the cost comparison method works out in a few specific cases. As we go along, I think you will find the answer to the frequently asked question, "Is fluorescent lighting cheaper than incandescent?" I think you will agree that the only possible answer is, "It all depends on the circumstances."

Chart 1 shows a comparison developed by the standard method between a fluorescent and an incandescent light-

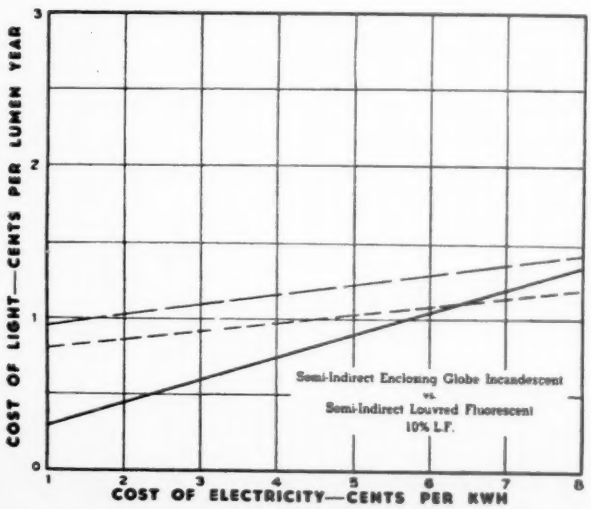


Chart 3

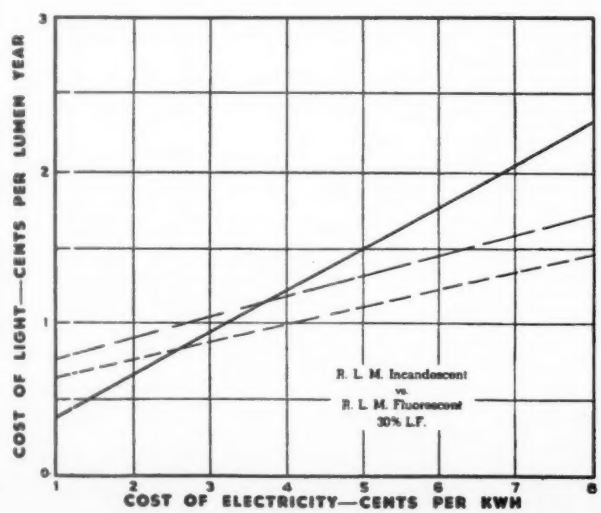


Chart 4

ing system which are judged to give approximately the same kind of lighting results in, say, an industrial office with a finished ceiling. The vertical scale represents the cost of lighting in cents per lighting unit or lumen per year. A number of other scales could be used, but this one was chosen in this case because the cost per light unit per year wipes out any difference in footcandle intensities when comparing two jobs.

The bottom scale is in cents per kwhr. Consequently, the slope of the line shows how the cost of lighting varies with the change in the rate for energy. The solid line shows the cost of this type of incandescent lighting system at various rates per kwhr. The short dotted line shows the cost of the comparable fluorescent lighting system using white fluorescent lamps. The long dash line refers to daylight fluorescent lamps. The point at which a fluorescent line and an incandescent line intersect represents a kilowatthour rate at which the cost of lighting with the two systems is the same. Please bear in mind that this chart represents a set of assumed fixed conditions with respect to investment costs, lamp replacement costs, and load factor, which in this case is 30 per cent, or about eight hours a day.

Chart 2 shows the same comparison except at 20 per cent load factor, or about five hours a day instead of eight. You will notice that the point of intersection between the white fluorescent line and the incandescent line is now at about 3½c per kwhr instead of 2¾c as in the previous case.

Chart 3 is the same comparison at 10 per cent load factor or only 2½ hours' use per day and the point of intersection has now moved to about 6½c per kwhr. Now on these three charts, the point of intersection has varied as the hours of use have varied. I hope it is clear that the intersection points would also be varied if different factors for amortization and depreciation had been chosen.

Chart 4 shows a comparison between a familiar incandescent RLM installation and a new standard RLM fluorescent installation. For the amortization and depreciation figures chosen and at 30 per cent load factor, you will notice that the point of intersection between white fluorescent and incandescent is 2¾c. You will observe, of course, that this lies well above increment rates for additional lighting which would be paid by many large industrials. However, remember that the answer depends entirely on the circumstances.

So much for the work of the diplomatic corps. Let's have a look, for a moment, at what the ordnance department has been doing. Changes in fluorescent lighting equipment have been coming along as fast if not faster than changes in pursuit ships or long-range bombers. At the present time, however, there are a number of more or less standard field pieces available for long range shooting. I think it would be well to compare one of these typical new units with the familiar incandescent RLM units. It takes about 1-1/6 of the incandescent units to give the same amount of light as this fluorescent lighting unit. Equated to the same light output, the facts relating to these two devices are as follows:

This lighting unit would use 230 watts while the fluorescent lighting unit would use about 100 watts or less than one-half. However, the list price of the incandescent lighting unit would be only about $5.00 as compared to about $30.00, or six times as much for the fluorescent lighting unit. On a 1,000 hour basis, the cost of lamp replacements, for the incandescent unit would be, at list price, about 46c as against about $1.80 for fluorescent lighting. The significant factor is the tremendous difference in the lighting results from the standpoint of color, glare, shadow and heat. In some situations, these factors are extremely important. In other situations, they are not.

The point to be emphasized is that this new piece of artillery can, on some jobs, be aimed higher and can shoot farther than the incandescent equipment. Now a single rookie may be entrusted with a cheap rifle and sent out to do a little sniping. However, a highly intricate and valuable piece of artillery must be handled by a thoroughly trained crew. There must be complete cooperation between scouts, observers, gunners and supply. Industrial lighting, which is truly useful to the customer, can no longer be sold on a rule-of-thumb basis. The problem is the production of maximum visibility, based upon a careful analysis of the seeing tasks. The men who aim to serve the customer well must understand the problem and the equipment. There must be cooperation between utility men, contractors, jobbers and manufacturers. The customer must have the truth and all of the truth. With careful engineering, the customer can be given the benefit which comes from jobs of high intensity and good quality. However, if we fall down and allow him to merely substitute 100 watts for 230 watts, the customer gains very little and we suffer an inexcusable defeat.

Now, what kind of action in 1940 is indicated by the present fluorescent lighting situation? There must be concentration on carrying out the policies which have been set forth by the general staff. This means getting the field forces behind the lines for training. Already, reports are coming in from many utility's territories of fluorescent lighting schools at which all those interested in fluorescent lighting are being assembled for training and for a better mutual understanding. These schools are being sponsored by local electrical leagues or by utilities themselves. Reports are coming in also about various kinds of action to meet the power factor problem. This action is taking a variety of forms with a general emphasis upon the promotion of the so-called two-lamp transformers as a practical solution in many cases.

Right now there is a new barrage of propaganda. For example, in the last issue of *Electrical Contracting,* 17 out of 100 pages carried data on fluorescent lighting. We have a golden opportunity to cash in on this enthusiasm. However, we must be on our guard. If propaganda is misleading, we must not let it pass. Even now, for instance, some advertising fails to tell the buyer about the watts used by fluorescent lamp auxiliaries. You know that a 40 watt lamp is nearer 50 watts on the meter. We must refuse to be "rubber stamps" and continue to criticize unsound fluorescent lighting proposals.

Yes, there are still many dangers ahead. However, with at least some degree of agreement, between the general staff policies of the major armies in the conflict and with better discipline among the troops on the firing line, it seems possible that we can go forward to new victories. Tomorrow's headlines should tell of our reaching new positions in better lighting. As evidenced in the Sales Committee's resolution, utilities agree that even though the weapons are different, the battle cry which has led the entire electrical industry to victory during the past six years is as good or better than ever for our 1940 campaign. I mean the battle cry of "BETTER LIGHT—BETTER SIGHT."

Electric Roaster Plan Book for 1940 Distributed This Month

UTILITY companies seeking profits from electric roasters will find the way in The Modern Kitchen Bureau's 1940 Roaster Plan Book, distributed earlier this month. The Plan Book presents a pattern which can be followed with a practical certainty of success, and those who are unfamiliar with patterns of this nature will find eight splendid demonstrations of how other utilities have followed the MKB pattern most advantageously.

The Plan Book, *A Pattern for the Profitable Promotion of Electric Roasters,* offers detailed records showing how utilities adapt the Bureau's 1939 roaster program to their own local conditions. Duquesne Light Company, for example, exceeded its goal of 5,000 units for 1939 by more than 50 per cent, following the MKB pattern. Indianapolis Power & Light Company placed emphasis on merchandising roaster-selling ideas to dealers instead of driving intensively for unit volume, and believes it has laid a complete educational groundwork sure to produce sales volume this year.

The Electrical League of Cleveland last year campaigned roasters through June and July, and again from the middle of November to Christmas. Following the MKB pattern, the League sold 13,200 electric roasters, exceeding 1938 sales by 27 per cent. Florida Light & Power Company uses the electric roaster as a residential valley-filler, and shows a steady growth of dealer sales of roasters for several years past. Dallas Power & Light Company travelled right along the MKB path to profits and jacked up its roaster sales last year 26 per cent over 1938.

Texas Power & Light Company boosted roaster sales from 600 in 1938 to 1,600 in 1939, an increase of 167 per cent. Monongahela West Penn Public Service Company got an 87 per cent increase last year over the year before. Two mid-West utilities, following the MKB pattern, succeeded in increasing dealer sales in a special May promotion in 1939 to 1,700 as compared to 500 in a similar month's promotion the previous year.

These records are all presented in complete detail in the Bureau's 1940 Electric Roaster Plan Book. They comprise a wealth of valuable information which any utility can put to profitable use. Together they bring indisputable evidence that there is a definite campaign pattern which inevitably produces a successful roaster promotion. The Modern Kitchen Bureau, in developing this pattern for utility use, believes it has performed a valuable service to the industry.

The organization of complete dealer cooperation is fundamental to success in any roaster campaign, the Bureau believes. The Plan Book sets forth eleven ways for achieving this cooperation, and makes it clear exactly what each dealer who participates should be expected to do. For example, the program suggests the spot-lighting of national activities and sales on roasters, showing the dealers what they have been missing; showing 1939 MKB national advertising and 1940 roaster manufacturers' advertising reaching people in their territory; suggesting that dealers capitalize on the advertising to sell their own customers; presenting previews of utility roaster advertising; doing the same with radio announcements and billboard posters; and so forth through a list of activities all designed to bring the dealer wholeheartedly into the fold.

The part which meetings play in successful roaster campaigns is fully explained. Three important types of organization meetings are described. The first is designed to win the support and cooperation of the distributors in the utility's territory. Then there should be dealer meetings, and, finally, meetings for dealer sales people, department store sales people and outside sales people. All the details for each of these meetings, and the results they should achieve, are clearly set forth. All the utility organization needs to do is to "follow the pattern" set down for its benefit.

No program, of course, can succeed unless it eventually reaches the customer. Here are some of the ways suggested by the MKB roaster program. It all boils down to letting people see and smell and taste and eat food that is cooked in an electric roaster. Once people have had these experiences they have commenced to learn some of the many benefits they can receive from owning a roaster, and become good prospects for roaster sales. Demonstrations may be conducted in dealers' stores, in customers' homes, in department stores, theatres, large auditoriums, or cooking schools. Each requires a slightly different technique, but all these techniques are treated with detailed explanation so that there is no possibility of failure if the pattern is followed. The basic importance of educating women, both young and old, in the uses and conveniences of the electric roaster is an extremely important part of the Bureau program.

Vitally important in the sale of a roaster is that it go on the line and continue in use. Thus a follow-up is certain to pay big rewards. The utility home economist plays the leading role here. On her visit to the new roaster purchaser to offer helpful suggestions as to its use, the home economist will make certain, too, that the housewife can use it conveniently and will continue to do so.

As its summary the Plan Book suggests three specific jobs which, when done, will make the campaign a real success. Job No. 1 is to advertise through newspapers, by radio, on billboards and by direct mail. Job No. 2 is to furnish its stores and dealers with window banners, counter cards, blow-ups of national advertising and merchandise display. And Job No. 3 is the vital one of dealer cooperation.

While the Bureau rests its own national advertising on the splendid job done last year in *Woman's Home Companion, McCall's Magazine* and *Saturday Evening Post,* the roaster manufacturers themselves are providing an abundant program of national advertising this year. Thus the dealer can display national advertising on the very brand of electric roasters he sells. This provides an important advantage for the dealer who is supplied with blow-ups of advertising centering around the make of roaster he is displaying.

All this program is laid on the table for careful inspection in *A Pattern for the Profitable Promotion of Electric Roasters.* Utilities which have not already received copies of this newest MKB Plan Book should write to the Bureau for it at once.

State Regulation of Gas and Electric Companies in Connecticut

By J. W. Alsop

Chairman of the Public Utilities Commission, State of Connecticut

From a radio talk over Station WDRC, April 23

IT is now the universal practice throughout this country that the furnishing of certain essential public services, such as gas and electric, shall be carried on only by corporations especially chartered for the purpose.

Connecticut was one of the first states to adopt the practice of issuing special charters to public utilities and to set aside districts to be served exclusively by each such utility. It was probably also the first to realize that the State, having granted special powers to a utility, was under a moral obligation to its citizens to see that no improper use was made of such privileges.

As early as 1792 there was established a commission having to do with the location and conduct of traffic over certain toll roads. In 1802 a commission was established and put in charge of the Milford-Stratford toll bridge, now known as the Washington Bridge. Again, in 1822, when the Farmington Canal was projected, one of the first steps was the appointment of a Commission to supervise the financing and the general operation of that project. The present Public Utilities Commission was established by our Legislature in 1911, after full discussion having been had at three sessions. Governor Simeon E. Baldwin took great interest in its establishment and saw to it that every possible safeguard should be contained in the law to the end that the administration of the Commission might be entirely free from political influence.

The law establishing the Commission provides, among other things, that Commissioners may be removed from office for active participation in political management or campaigns. No member of the Commission or of its staff has ever been allowed to have any part in political matters.

The Commissioners are chosen in the same manner as are the judges of our higher courts as they are nominated by the Governor and appointed by both houses of the General Assembly. There are three Commissioners and the term of office is for six years, so that at each session of the Legislature one Commissioner comes up for appointment or reappointment.

The original Commission, appointed by Governor Simeon E. Baldwin, consisted of an attorney, an engineer and a business man. This practice has been followed ever since. It might interest you to know that I was appointed by Governor Holcomb in 1917 and have now served for a longer period, with one exception, than any other similar Commissioner in the United States. Commissioner Edwy L. Taylor, an engineer of New Haven, was appointed in 1931, and Commissioner Alvan Waldo Hyde, an attorney of Hartford, was appointed in 1934.

The Commission is an administrative body, although very many of its duties are of a quasi-judicial nature. From time to time the scope of its work has been added to, so that at the present time it is the duty of the Commission to keep itself fully informed as to the condition of the plant and equipment and manner of operation of all electric and gas companies, in respect to their adequacy and suitability to accomplish the duties imposed on them by law, and in respect to their relations to the safety of the public and their employees. The Commission may order such reasonable improvements, repairs and alterations in the plants of these companies, or such changes in their manner of operation, as may be necessary in the public interest. The companies may not merge or consolidate, or issue bonds, stock or other securities except after hearing and approval by the Commission; furthermore, the Commission is empowered to prevent the exercise of outside holding company control over the operations of any of our Connecticut companies. The Commission has jurisdiction over rates, with power, when such action shall appear necessary or suitable in the public interest, to determine whether any schedule of rates is discriminatory or more or less than just, reasonable and adequate, or that the service furnished is inadequate for or in excess of public necessity.

All companies make detailed annual reports on standard accounting forms covering their entire operations for each year. These reports are carefully studied by our Accounting Division and we are thus kept fully informed of every detail of the financial operations of each company.

All our work has to be carried on in conformity with a very large number of State and Federal statutes concerning the operation and conduct of utilities, and all of our decisions are very properly appealable to the Courts. Only once in the last 15 years has a decision of the Commission concerning a gas or electric company been reversed, and that for the reason that the amount allowed by the Commission to the Company was not sufficient in the opinion of the Court.

We are indeed fortunate that our companies are nearly 100% intrastate in their nature, that is, they serve only customers in Connecticut. There is a small company in the southeastern corner of the State which is part of a larger out-of-State system serving across the line in Rhode Island. The Connecticut Power Company has a line extending from Hartford to Holyoke in Massachusetts, in turn connecting with the various power plants on the Connecticut River. This line is used solely for the purpose of economy and is on a non-profit basis. Its operation is as follows: Although the Connecticut River is not a dependable source of power during many months of the year; however, when it does have a surplus of water and the power plants in the north have extra capacity for which they have no use they ship down to the Connecticut Power Company as much of this excess as the Connecticut Power Company may wish to use. During the months of the year when the River is low the Connecticut Power Company ships north power made by

steam at Hartford. These shipments are so-called dump power. Kilowatthours are exchanged and the only payments made, which are at cost, cover the difference between the amounts shipped north and south. It can readily be seen that this whole transaction is purely one for economy and an added connection in the case of an emergency, but it is under this guise, for some reason which to a Connecticut mind is not understandable, that outside control is assumed over the Connecticut Power Company although it serves no single customer outside of our State.

The Commission spends a great deal of its time on matters of standardization of lines and equipment, etc., for instance our engineers have, for years, prepared and kept up to date specifications on pole lines for all wire companies and those specifications, long ago adopted in this State, have now been adopted practically on a national basis, so that in the hurricane of 1938 it was possible for many hundreds of linemen to be brought from other States into Connecticut to aid in the rapid restoration of our electric lines which had been levelled by the storm. Did it ever occur to you that a lineman, no matter how skilled, who was put on work of some different standard of construction than that on which he had been trained would necessarily take weeks to become accustomed to it?

The question of most interest to you will be the question of electric rates. Under our law a Company is entitled to no more than a fair return on its property used and useful in the service of the public. In dealing with rates, therefore, it is the duty of the Commission to see that schedules of rates are established to raise no more than sufficient revenue to pay proper operating expenses, taxes and a fair return on the value above stated. The number of shares of stock which the Company has outstanding or the amount of bonded indebtedness, have no place whatever in the question of deciding upon rates. That depends, first, on deciding upon the fair value of the property of the company and, thereafter, the finding of an appropriate revenue to bring about the above results.

I do not remember a time when the Commission has not been in negotiation with one or more of our electric or gas companies, in regard to rate questions.

Comparisons of electric rates are constantly being made, usually for political reasons. Such comparisons may only fairly be made if they apply under conditions which are similar or very nearly similar, and such comparisons may not be made fairly between states nor even between companies in a state as small as Connecticut, unless conditions are the same.

I know of no two companies even in this little state where this is so, because the companies vary in many ways, as do the communities, in characteristics such as density of service rendered, type of service demanded, and utilization of current by customers.

Nevertheless, comparisons may be made in rates available in different years. The records show that during the last twenty years, rates in this state have been reduced about sixty per cent, while during the last ten years reductions have been made by our companies which have resulted in annual savings to customers of approximately six millions of dollars per annum. It is difficult to think of any item of living expenses which has shown such a marked and consistent reduction in the same period of time. The Commission will continue to negotiate rate adjustments as frequently as improvements in the art, increased consumption, and other factors, will warrant.

Another important aspect of the work of the Commission is in regard to rural electrification. The Commission has complete and detailed information on this subject covering the entire territory of the State. There now remain only about 1,000 miles of lines to be built to make service available throughout the state where the density of customer population is as much as three to the mile. During the past year 287 miles of such lines were built, so it is plain that in a very few more years service will be available practically one hundred per cent throughout the country districts. We are undoubtedly third and probably second in the United States in the extent of our rural electrification.

Our gas and electric companies in 1912, when the present Commission started its work, represented an investment in plant and equipment of less than 35 millions of dollars. Today this investment is over 231 millions of dollars. In 1912 approximately 210,000 customers were served while today they serve about 800,000 customers.

During the past year these companies paid in taxes $7,200,000. More than half of this, or about $3,625,000, went to the Federal government; $2,450,000 of it went to our towns and cities in property taxes; and $1,125,000 went into the general fund of the state. It is not often realized what efficient and productive tax collectors for the state and its towns and cities our utilities are.

The staff of the Commission is made up of experts consisting of engineers, accountants, and men experienced in tariff work. Its entire staff numbers less than fifty.

That part of the expense of the operation of the Commission which has to do with the regulation of gas and electric companies is about $60,000 per annum. In view of the amounts paid by these companies in taxes, it becomes clear that our Connecticut regulation is carried on in accordance with Yankee ideas of economy.

Connecticut is a small state. Hardly anybody in it lives more than one hundred miles from the State Capital. The members of the Commission and its staff are Connecticut people who understand Connecticut ways. We have daily contact with individuals from all parts of the state and welcome visits and correspondence with any citizen of Connecticut having any question to ask or problem to work out which is concerned with the administration of the laws entrusted to us. We endeavor to deal fairly at all times with every member of the public, whatever his state or condition, and equally fairly with the utilities under our jurisdiction.

PUAA Convention at Chicago in June

THE annual convention of the Public Utilities Advertising Association will be held in Chicago June 23 to June 26 with the Palmer House as headquarters, according to an announcement by Keith Hartzell, of Bristol, Tenn., president of the association. The convention will be held in conjunction with the annual meeting of the Advertising Federation of America, scheduled for the same dates.

Mr. Hartzell also announced appointment of the committee on arrangements for the convention, with Clayton G. Cassidy, The Peoples Gas Light and Coke Company, Chicago, as chairman, and Charles W. Tennant, Western United Gas and Electric Company, Aurora, Illinois, as vice-chairman.

A feature of the utility meeting will be an exhibit of advertisements winning awards in the association's nationwide Better Copy Contest. J. W. Hicks, of the Public Utility Engineering and Service Corporation, Chicago, is chairman of the committee in charge of the exhibit.

The Electric Utilities' Exhibits at This Year's New York World's Fair

"ELMER," the average American, is the focal point of the New York World's Fair in its 1940 incarnation; and it is to Elmer and Elmer's wife that Forward March of America and the Electrified Farm, the two exhibits of the Electric Utilities Exhibit Corporation, also are dedicated. The viewpoint of the folks who are in most cases the direct, and always the ultimate, consumers of electricity has been the guide in the revamping that has been done this year. Emphasis has been placed on the fact that the exhibits are designed to tell the service story of the electric light and power company "back home," and the Electric Utilities Exhibit Corporation is cooperating in the tying-in of local promotional campaigns.

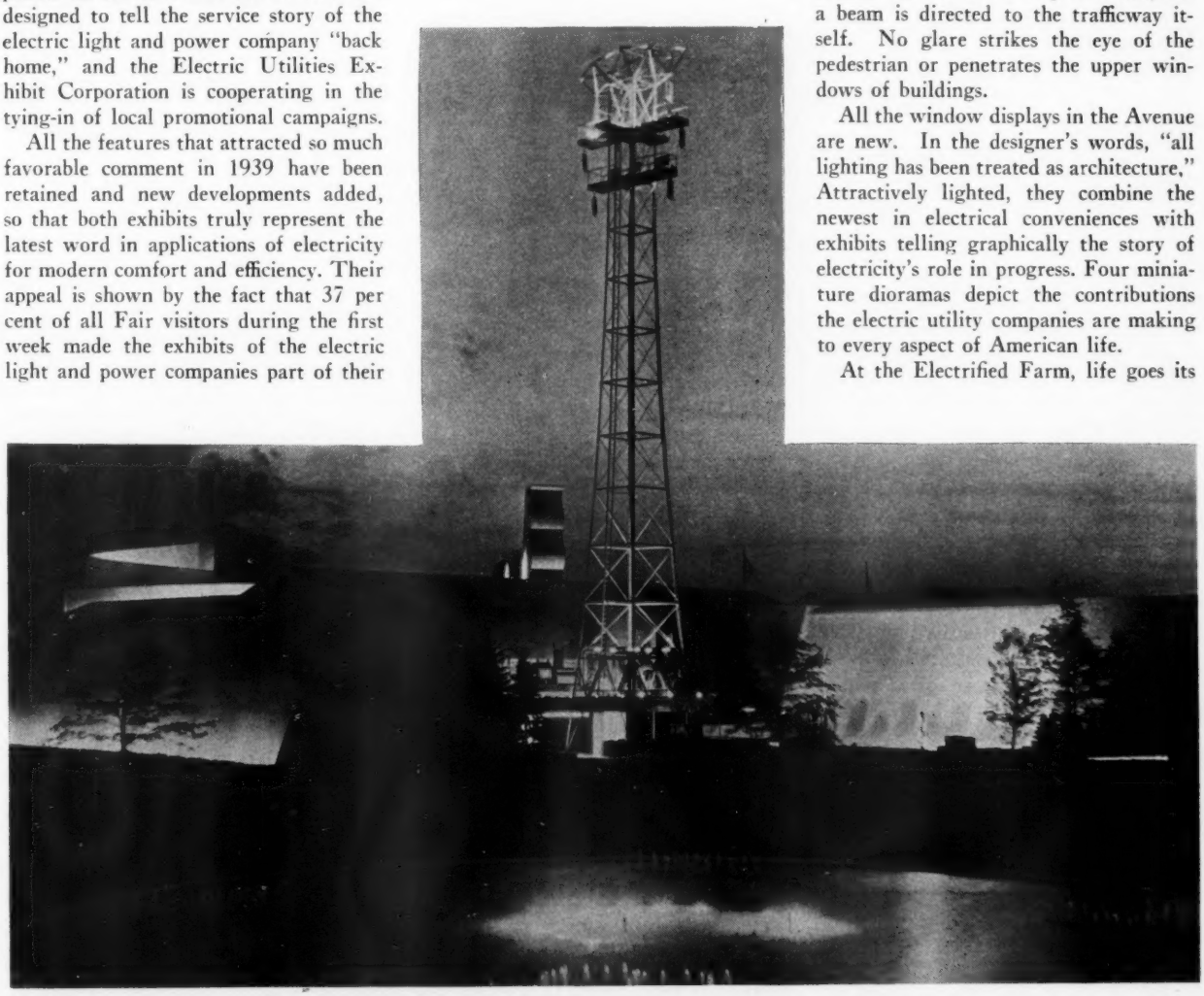
All the features that attracted so much favorable comment in 1939 have been retained and new developments added, so that both exhibits truly represent the latest word in applications of electricity for modern comfort and efficiency. Their appeal is shown by the fact that 37 per cent of all Fair visitors during the first week made the exhibits of the electric light and power companies part of their program, as compared to 21 per cent a year ago.

New interest has been given the entrance to the Street of 1892, first section of Forward March of America, by a series of 11 "living stills," three-dimensional miniatures mounted in the walls. These, the creation of Walter Jagemann, carry out the entrance theme of "time turning backward through the years" by depicting scenes of American life ranging from the Palm Beach of 1940 to the general store of 1892, where the news of Cleveland's election is being received. In the old street itself nothing, appropriately, is new. The cobblestone paving, the hissing gas lamps along the curb, and the quaint window displays are a musty breath from the past.

The most striking change in the Avenue of Tomorrow, modern half of this exhibit, is in the street lamps. These are of a new design, not yet in actual use anywhere. Only a narrow ring of light escapes to the sidewalk to supplement the illumination from the shop windows, but a beam is directed to the trafficway itself. No glare strikes the eye of the pedestrian or penetrates the upper windows of buildings.

All the window displays in the Avenue are new. In the designer's words, "all lighting has been treated as architecture," Attractively lighted, they combine the newest in electrical conveniences with exhibits telling graphically the story of electricity's role in progress. Four miniature dioramas depict the contributions the electric utility companies are making to every aspect of American life.

At the Electrified Farm, life goes its



A night view of Forward March of America, with the waterfall floodlighted

pleasant, modern way for the rural Elmers, with electricity making farm living as comfortable as city dwelling and farm work easier and more profitable. Of the 200 farm jobs which can be done electrically, over 100 are demonstrated in actual use at this exhibit, which includes a house, barns, orchard, poultry house and other farm buildings on less than an acre. The Farm shares interest with the Forward March of America, attracting as many urban visitors as farmers.

Just across the Plaza of Light from the Forward March of America, the Consolidated Edison Company of New York again this year enthralls thousands of visitors daily with its "City of Light" diorama, which is estimated to have drawn 7,500,000 attendance in 1939. This colored, lighted, animated model of the New York metropolitan area has been improved by the addition of new sections representing Westchester and the Brooklyn park area and by installation of animated ferry boats, animated suspension bridges, 25 new electric signs, an animated fire engine, new night lighting effects, new subway equipment and "sky spectacles"—colored picture reproductions. Narration, music, sound effects, lighting and picture projections have been newly combined to tell in 12

(*Continued on page 230*)

Above—The Avenue of Tomorrow

Left—De luxe transportation in the Street of 1892

Below—A corner of the Electrified Farm

The Annual Meeting of the Engineering Committees

By Alexander Maxwell
Director of Engineering, E.E.I.

IN conformity with recent custom the engineering committees met together in Chicago the first week of May. The regularly scheduled meetings of the standing committees extended through three days, May 6, 7 and 8, and supplementary conferences and informal meetings of smaller groups occurred on Sunday and Thursday, so that the activities as a whole extended over five days. The recorded attendance was 350, and in addition a substantial number of guests attended one or more sessions. This Chicago meeting provides an excellent opportunity for the junior engineers of middle western companies to participate in the deliberations of the national committees of the industry.

The activities and accomplishments of the several engineering committees suggest a little reflection on their history. As usual they were uniformly active at this meeting and their programs were well filled with pertinent and highly practical subjects. It is, of course, not possible to deal here with the details of the subjects discussed and in any case these are recorded elsewhere in this issue. This group of committees, comprising the Prime Movers, Hydraulic Power, Transmission & Distribution, Electrical Equipment, Meter and Accident Prevention Committees, cover in their respective spheres the entire range of the electric power supply industry in the fields of design, construction and operation.

It may also be interesting to record that these committees are still substantially on the same basis as to organization and numbers that they were at the time of the organization of the Edison Electric Institute. In cases where the personnel of committees has been increased this has been at the direct request of member companies who desired that certain of their engineers should be members of certain committees. The total number of individuals comprised in the membership of these five committees is 159, and in addition to this general meeting in the spring the committees hold two other meetings in the course of the year, on the average.

These statistics are referred to because it is notable that out of this relatively small number of men who give, of course, only part-time attention to committee activities, there comes the substantial output of engineering reports, standard practices, statistics and other material relating to the industry which has achieved a sound position in the engineering literature of the art. Further, it is to be taken into consideration that all committee activities do not necessarily end in the production of reports. Many subjects are examined and disposed of without the necessity for a permanent record, others merely suggest an interchange of experience without conclusive findings one way or another.

One of the most highly prized features of work in several of the committees and one that is practised to a greater or lesser extent in all committees has been the so-called "round table" discussion. Such round tables, which are ordinarily restricted to the appointed personnel of the committees, deal in the most direct manner with current problems of design and operation and many questions of lively interest in the engineering field are profitably disposed of in such meetings, merely by an interchange of experience. It may be readily understood that by the time such topics became the subject of a printed report, the interest in them would have disappeared, yet at the moment when they are discussed they are both timely and important.

It is not difficult to appreciate the important effects that this committee work has had upon the development of the art although it may be difficult to express it quantitatively. It may be observed that this systematic interchange of ideas and experiences operates toward the discouragement of poor practices equally with the promotion of good practices, but while the latter activity may leave a permanent record, the former is very likely not to do so. It is difficult to appraise the money saving due to disadvantageous practices quietly laid to rest that might have attained considerable currency if their shortcomings had not been revealed.

The amount of work done has required that the engineering committees schedule their programs carefully and organize debate for the best possible use of the available time. Thus these meetings actually become hard-working sessions for the members and require a good degree of administrative ability on the part of the chairmen and secretaries. In this respect the committees have been singularly fortunate.

The circumstance, noted above, that the burden of this committee work for reasons of economy rests upon the shoulders of a comparatively small body of men, has a corollary effect in the resultant circumstance that the benefits of committee work, apart from printed reports, are not available to a much larger body of men who, according to indications, would be glad to avail themselves of such gatherings if it were possible to do so. Recognition of this situation has led many of the committees to conduct as many as possible of their sessions as open meetings. Open, that is to say, to all utility employees who desire to attend. Further, it has led the committees to distribute their meetings over as wide an area as may be consistent with economy of travel, and to cover as many different regions as practicable within the principal zones of Institute company membership.

The beneficial effects of these practices have been plainly observable. Certain committees have frequently had meetings with an actual member attendance of perhaps twenty-five where the total attendance has sometimes been as high as a hundred. This excess attendance over the actual membership has been entirely voluntary, of course; it provides good testimony to the favor in which such meetings are held, locally, by those interested in the subjects and qualified to attend.

Such meetings provide little opportu-

nity for relaxation and little is attempted beside the annual dinner for all of the committee members, which has become somewhat of a fixture. This year a novel and notable feature was introduced, which consisted of a lecture by Mr. F. T. Hague of the Westinghouse Electric & Manufacturing Company on the research on turbine blade vibration conducted by that company at its Philadelphia Works and more recently in cooperation with the Philadelphia Electric Company at the Schuylkill Station. This lecture, which was given on Monday evening, was highly appreciated by all who attended.

The customary dinner was held on Tuesday evening. This dinner provides the only occasion, in view of the crowded programs of the committees, for a general get-together of the members of the several committees. It also provides an opportunity for any feature calculated to be of general interest to all of those present in contrast to the more highly specialized subjects dealt with in committee meetings. On this occasion an address was given by Mr. A. G. McNish of the Department of Terrestrial Magnetism of the Carnegie Institute on magnetic storms generally, and particularly on the intense magnetic storm of March 24, 1940. This subject was of special interest, and it may also be interesting to note it here, for the reason that this storm for the first time in the history of electric power supply was of sufficient intensity to cause its effects to be quite commonly noticed on electric supply systems.

It cannot be said with certainty that such effects have never been observed on power systems before, but if so they have been regarded as a scientific curiosity and have not been generally reported, although the effects of magnetic storms are fairly well known and rather common on the more sensitive communication systems. However, on the occasion of the storm in question the effects, which are probably due to the flow of earth currents of enormous magnitude, were sufficiently marked to be quite plainly observed in several power systems. The typical manifestations were those of continuous currents observed in grounded circuits, the biased magnetization of instrument transformers, and in a few instances the unexpected operation of relays. Under the circumstances an authoritative explanation of these effects proved to be highly interesting.

Accident Prevention Committee Meeting

W. R. Smith, *Chairman*

THE third and last meeting for the current year of the Accident Prevention Committee of the Edison Electric Institute was held May 7 and 8 at the Edgewater Beach Hotel in Chicago. The afternoon session on May 7 was held jointly with the Transmission and Distribution and Electrical Equipment Committees, thus affording an opportunity for presentation by each committee of some matter of interest to all three.

At this special session the Accident Prevention Committee contributed a paper entitled, "Testing Rubber Gloves With High Voltage Direct Current," the authors of which were R. W. Chadbourn and W. H. Meade of the Engineering Department of the Boston Edison Company. W. B. Elmer of that company presented the paper as representative of E. C. Rue, a member of the Accident Prevention Committee.

Statistics for the year 1939, as reported by E. P. Durfee for J. E. Goodale, Consolidated Edison Company, based on reports from approximately 92 per cent of member companies, show improvement in the trends with respect to fatalities and lost-time accidents as compared with 1938; the figure on days lost remains about the same. This status, it is anticipated, will not be materially altered when returns are in from all companies. A measure of what has been accomplished in the industry in the ten-year period since 1929 is shown by a comparison of the ratios for the two years. There have been reductions of approximately 66 per cent in the number of lost-time accidents, of 50 per cent in the amount of time lost, and of 59 per cent in the number of fatalities.

The committee contemplates a study during the next four months of the cause and location of accidents in the industry as experienced during the years 1938 and 1939 in order to extend the information completed last year for the years 1936 and 1937.

Employee training for safety has had the committee's attention for some time. It is convinced that only complete training of all concerned, from supervisors to the individual workmen, can further reduce the number of accidents—these being mainly due today to human failure in some respect. Progress is being made in this study and the committee hopes that its eventual results will be of real assistance to member companies.

The chairman has appointed a Resuscitation Review Board, which will be headed by Dr. H. B. Williams of Columbia University. This board will examine reports on electric shock cases which will be solicited from all sources in accordance with the general procedure announced in this issue of the BULLETIN. The committee anticipates that through a study by this board of the nature of each shock and the physiological data pertinent to it, much important information will be obtained to the ultimate benefit of the industry, medical authorities and all others concerned.

The committee has maintained close contact throughout the past year with all other committees of the Institute and with various national agencies such as American Standards Association, National Safety Council, American Society of Safety Engineers and the American Institute of Electrical Engineers, in order that there may be coordination of all efforts toward the common end.

The aim of the committee in effecting this cooperation is to assemble and disseminate as widely as possible information relating to accidents and their causes and to recommend methods for their prevention, both directly and through education and training of employees. To this end, the committee desires to maintain close relationship with all similar committees or agencies as far as their activities pertain to the electric light and power industry, and extends an invitation to the members of any such groups to attend any open sessions that may be held by the committee.

Present plans are that the next meeting of the committee will be held in New York this fall. Place, date and an outline of subjects for discussion will be announced later.

Electrical Equipment Committee Meeting

H. L. Wallau, *Chairman*

THE spring meeting of the Electrical Equipment Committee was held at Chicago, May 6 and 7, along with the meetings of the other engineering committees of the Institute. Twenty-five members of the committee were present, and about twenty visitors attended the open session meetings.

The closed session on Monday morning was as usual devoted to a discussion of operating problems.

Mr. C. A. Corney of the Boston Edison Company presented a report on Apparatus Troubles. A total of 109 cases of equipment troubles were reported to the committee and summarized for the period from September 1, 1939, to March 15, 1940. Among the major equipment failures there were reported most frequently those involving large transformers (11), oil circuit breakers (6), frequency changers (5), synchronous converters (5), synchronous condensers (4), turbine generators (4), and hydro generators (3). Among minor failures most frequent reports were received on regulators (12), oil circuit breakers (9), large transformers (7), instrument transformers (6), distribution transformers (5), and equipment affecting turbine generators (4).

The committee also reviewed in detail the major system disturbances which have occurred recently. Among those discussed were the occurrences at St. Paul, Minn.; Richmond, Va.; Providence, R. I.; Los Angeles, Calif., and Gary, Ind.

Mr. Nicholas Stahl reported on the inspection made by the Electrical Switching and Switchgear Committee of the Association of Edison Illuminating Companies of recent developments in this field. The major development has been the introduction by the principal manufacturers of oil-less circuit breakers for use on circuits up to 15 kv.

Mr. R. W. Wilbraham reported that the Joint EEI-AEIC-NEMA Committee on Circuit Breakers had agreed upon a simplified schedule of tentative standards for oil-less circuit breakers 10 kv and above. This standard includes 5 breakers for rated voltage of 15 kv, and 2 breakers for a rated voltage of 34,500 kv. This simplified schedule was adopted after thorough study by the committee and a canvass of the needs of the industry for the next five years. It is expected that the reduction in the number of ratings will result in reduced cost of the breakers.

Mr. R. T. Henry presented a report on temperature indicators on transformers prepared by the AIEE Transformer Subcommittee, which contained the following conclusions:

1. The present type of hot-spot indicators with their errors, when considered from every angle, are the most practical type of indicator that can be furnished. These indicators are not intended to be precision devices, but are sufficiently accurate for practical purposes.
2. Indicators calibrated to read average winding temperatures at rated load would be misleading under overload conditions, as the difference between the average and hot-spot temperature of the windings increases as the overload increases. For heavy overloads this difference may be as much as 20 to 25°.

The consensus of opinion of the committee seemed to be that these devices in general left much to be desired, and that further effort should be devoted to developing some satisfactory method for indicating transformer temperatures under overload conditions.

Mr. A. E. Silver reported on the activities of the Meter and Service Committee. The new handbook for Electrical Metermen appeared on April 10 and within 30 days over 8000 had been ordered by utility companies. Among the items which the committee is now working on are: service cable, material for terminal blocks, standardization of current transformers for primay circuits, metering of low power factor loads. The committee is also in close contact with the so-called low cost meter to which considerable publicity has been given recently. The question of the use of cyclometer registers has also received considerable study. This device is available for present-day watthour meters at a slight additional cost. Its one outstanding advantage is the simplicity of reading by the customer. From the utility standpoint it has several disadvantages, among these being:

1. Increased cost of meter reading due to reduced speed in reading. This type register would considerably slow up reading and increase expense.
2. Increased initial cost of this type register over our present standard.
3. Increase in maintenance expense.
4. Greater register friction affecting meter accuracy.

Another article reviewing the meeting of the Meter Committee held on May 8 and 9 appears in this issue of the BULLETIN.

Mr. F. D. Wyatt reported some progress in the study of normal and emergency rating of equipment.

On Tuesday a joint meeting was held with the Transmission and Distribution Committee and the Accident Prevention Committee, where problems of interest to the three committees were reviewed.

Mr. Stanley Stokes, Chairman of the Subcommittee consisting of Messrs. C. E. Arvidson, H. A. Enos and R. A. Hentz, presented definitions relating to utilization voltage, which are to be reviewed by the committees, and after thorough study it is expected that these definitions, or modifications of them, will be adopted and their general use simplify the standardization in this field. The definitions presented include:

DEFINITION 1. *"(X) Utilization voltage"* is the voltage measured at the terminals of the machine or device (X).

In actual application the X, of course, would not appear, and in its place would be written "motor utilization voltage," "lamp utilization voltage," etc.

DEFINITION 2. *"Service voltage"* is the voltage measured at the terminals of the service entrance switch.

DEFINITION 3. *"Average voltage"* is the arithmetical average of the voltage existing during the period of time in question.

DEFINITION 4. *"Quadratic mean voltage"* is the root mean square of the voltage occurring within a designated period. In symbols, if T is the time interval and E(t) the voltage at time t, the quadratic mean voltage:

$$E_{qm} = \left(\frac{1}{T} \int_0^T E^2(t)dt \right)^{\frac{1}{2}}$$

This value can be easily and simply measured with a volt² hour meter which is a slightly modified form of watthour meter. It is expected that the use of this meter would result in simpler and more accurate measurements than can be obtained with recording meters.

There appears to be considerable advantage in the use of the quadratic mean voltage instead of average voltage, both from a standpoint of measurement and from the standpoint of the effective

voltage rendered to the customer. There is little difference in the numerical value and it is expected that only one of these terms will be used.

DEFINITION 5. *"Maximum voltage"* is the greatest 5 minute "quadratic mean voltage," (or "average voltage" if Definition 3 is used) subject to a proper time lag.

DEFINITION 6. *"Minimum voltage"* is the least 5 minute "quadratic mean voltage" (or "average voltage" if Definition 3 is used) subject to a proper time lag.

DEFINITION 7. *"Voltage spread"* is the difference between the maximum and minimum voltages.

DEFINITION 8. *"Rated (X) voltage"* is the voltage or voltage range for which the machine or device (X) is designed to operate. It will be considered as equivalent to the voltage or voltage range appearing on the name plate.

DEFINITION 9. *"Nominal voltage"* is a fixed reference level of "service voltage" for a system.

Following thorough study by the members of the committees these definitions will be taken up again at the October meeting.

Mr. J. H. Foote presented his preliminary report on Utilization Voltage. This report gives the result of extensive survey of voltage conditions throughout the country and points out some of the major factors involved which are impeding prompt agreement. Some of these are:

a. The use of an established lamp voltage rating which is regarded as the chief criterion for service voltage standardization.

b. Rules established by public authorities, the voltage limits of which are stated actually to be in effect.

c. Unfortunate incidents involving either high or low voltage at some time which form the basis of rules or standards of design.

d. The basic difference in the relations between single phase and three phase voltages in Y-connected and delta-connected secondary systems.

This paper was discussed in considerable detail by W. R. Bullard, R. A. Hentz and A. K. MacNaughton.

Mr. C. E. Arvidson presented a paper discussing the use of branch feeder regulators. The branch feeder regulator is a relatively recent development and there have been a number of changes in design since its first introduction. The use and limitation of this device were covered in Mr. Arvidson's discussion.

Mr. R. N. Conwell presented a discussion illustrated with moving pictures —the experience of the Public Service Electric and Gas system on February 14, 1940, where weather conditions were such that a light glaze of irregular cross-section formed on the wires, which, together with transverse winding, resulted in dancing or galloping of the conductors. In this paper the following conclusions were drawn:

1. The infrequent occurrence of the phenomenon of "dancing conductors" precludes the economic possibility of reconstructing lines to minimize the hazards.

2. On double circuit tower lines, occupied by one circuit, additional spacing may be secured by utilizing the top and bottom arms on one side of the tower and the middle arm on the other side. With a normal 13-foot vertical spacing between arms this would provide ample clearance on 800-foot spans between conductors when dancing occurs.

3. As a temporary expedient, some relief might be obtained on double circuit lines, either tower or wood pole, by opening three disconnects at both ends of the line (B phase of one circuit and A and C phases of the other) thus forming a new circuit with increased clearances between line conductors.

4. In those areas where dancing is prevalent, some method of electrically loading the lines may be required to melt the glaze or prevent its formation.

Mr. W. V. Elmer presented a paper describing the testing of rubber gloves with high voltage dc. This paper presented the research work which had been done to determine the feasibility of the use of high voltage dc instead of ac for the testing of rubber gloves. It pointed out how the dc was more effective in locating minor defects in the gloves and also more effective than careful inspection for such defects. Where routine dc tests are used there appears to be a question as to the necessity of continuing the standard ac tests.

Mr. W. G. Miller described a device developed by the Detroit Edison Company for short-circuiting a distribution circuit in less than 2 cycles, where a fault occurs on the distribution circuit. Experience and tests have shown that it is impractical to obtain for distribution circuits sufficiently fast relaying to avoid possible damage to the conductors at the time of flashover. Through this newly developed device it is possible to short-circuit the arc within two cycles, thereby avoiding burning of the conductor and promptly clearing the circuit through the regular station circuit breaker. After the initial operation the short circuiting device is locked out and the breaker reclosed and subsequent operations are in the usual fashion for the clearing of any permanent faults.

Meter and Service Committee Meeting

A. B. Craig, *Chairman*

ON May 8 and 9 the third meeting of the 1939-1940 Committee year was held at the Edgewater Beach Hotel, Chicago. About 50 persons, including members and guests, were present.

The business session was opened on Wednesday, May 8. The members discussed metering problems and subject groups reported on various projects being studied.

Many favorable comments were received on the new Electrical Metermen's Handbook which is now available. The editorial committee composed of Messrs. O. K. Coleman, A. J. Allen and L. D. Price were highly praised for the excellent work performed in this revision. It was reported that over 8000 copies were ordered and distributed within the first 30 days of publication. The book was published April 10.

One subject which has received considerable attention in the past is Standard Dial Constants. In the February, 1939, issue of the E.E.I. BULLETIN, the Committee published an article entitled, "Economics Through Simplification of Customers' Meters." This article included a Standard Practice for Dial Constants of Alternating-Current Watthour Meters designed to modernize the registers of these meters so that they would be more closely coordinated with the improved overload capacity of the modern meter. The manufacturers of meters, as well as the Committee, have not been entirely satisfied with the degree of acceptance of this new standardized practice. After due consideration of all objections to date, however, the Committee still feels that this new standard is not only necessary but also advantageous. For the benefit of those who have no previous knowledge of this standard or who may have misunderstood its intentions, an article has been carefully prepared which restates the case. This article will soon be published in the BULLETIN as well as in other electrical journals.

A report of progress was made on the Revision of the Code for Electricity Meters. An editorial committee has been formed to correlate the work of the various sections. This committee is composed of representatives of utilities, manufacturers, and the Bureau of

Standards. This work is progressing rapidly.

The subject of obtaining a more suitable material for meter terminal blocks is being actively followed, and tests are being made by the manufacturers on several new materials.

Steps are being taken to have the standards of the Committee issued in separate pamphlet form by Headquarters for convenient reference and availability. A subcommittee will be appointed to correlate these standards and review them for publication.

In addition to the above-mentioned items, other subjects being studied by the Committee and on which considerable progress was reported included the Standardization of Current Transformers on Primary Circuits, Demand Register Scales, Thermal Demand Meter Ratings and Scales, and the Metering of Low Power Factor Loads.

Special honor was tendered Mr. A. G. Turnbull, one of the pioneer metermen of the Commonwealth Edison Company, on the occasion of his retirement after 45 years of service. In past years, Mr. Turnbull took a very active interest in work of the Meter Committee of the National Electric Light Association and held many important offices including the chairmanship in 1925-1926. On May 7, many members of the Committee attended a testimonial dinner in his honor.

On May 9 a joint meeting of the Meter and Service Committee with the A.E.I.C. Committee on Metering and Service Methods and representatives of the meter manufacturers was held for discussion of problems of mutual interest.

Transmission and Distribution Committee Meeting

W. F. Nimmo, *Chairman*

THE Twenty-first meeting of the Transmission and Distribution Committee was held at the Edgewater Beach Hotel in Chicago on May 6, 7 and 8, coincidentally with the group meetings of the engineering committees of the Edison Electric Institute.

The first day of the meeting was devoted to papers and discussions on subjects relating to the work of the Underground Group and dealt with the general subject of Corrosion. Mr. M. W. Ghen of the Duquesne Light Company presented a report covering the work of the Joint Corrosion Committee for Electrolysis Mitigation.

Mr. W. T. Pierce of the American Steel and Wire Company presented a paper on the American and English practices in cable sheath corrosion protection. With this was distributed a copy of a paper entitled "The Corrosion of Underground Cables" by Messrs W. G. Radley and C. E. Richards, which appeared in the *Journal of the Institute of Electrical Engineers* (London) for December, 1939.

Other papers presented and discussed with interest were:

"Electrolysis Measurements and Cathodic Protection," by A. S. Brookes, Public Service Electric & Gas Co.

"A Study of the Formation of Red Oxide as a Corrosion Product," by Edgar F. Wolf, Consolidated Gas, Electric Light and Power Co. of Baltimore.

"Corrosion-Inhibitive Coating for Buried Lead-Covered Cables," by W. D. Sanderson, The Detroit Edison Co.

"Electrolysis and Corrosion, Underground Cable, Gas, and Steam Piping Systems of the Consolidated Edison Co. of New York, Inc.," by L. J. Gorman, Consolidated Edison Co. of N. Y., Inc.

"Method for Survey of Stray Sheath Current on Cables in Ducts," by F. Kahn, Philadelphia Electric Co.

Following the presentation of these papers, various subjects were discussed by Mr. H. G. Hall of the Detroit Edison Co., Mr. R. M. Burns of the Bell Telephone Laboratories, Mr. W. A. Del Mar of the Habirshaw Wire & Cable Co., Mr. L. I. Komives of the Detroit Edison Co. and Mr. T. G. Hieronymus of the Kansas City Power & Light Co.

The forenoon of the meeting on May 7 was devoted to meetings of subject sessions. The Subject Sessions for Standards for Distribution Transformers and Field Load Testing of Distribution Transformers, under the sponsorship of Messrs. A. E. Silver and F. E. Sanford respectively were combined into one meeting. Others were held as follows:

Street Lighting Standardization, W. B. Elmer, Sponsor

Three Clearances, G. D. Blair, Sponsor

Coordinated Protection to Persons, Service and Equipment, G. S. Van Antwerp, Sponsor

Beginning at 11 a. m. on May 7 and extending throughout the remainder of the day, was a joint session of the Accident Prevention Committee, the Electrical Equipment Committee and the Transmission and Distribution Committee, with Mr. H. L. Wallau, Chairman of the Electrical Equipment Committee, presiding. Subjects covered in this joint session were as follows:

"Utilization Voltages and Definitions," by J. H. Foote, Commonwealth & Southern Corp.

"Branch Feeder Regulator Practices," by C. E. Arvidson, Commonwealth & Southern Corp.

"Dancing Conductors," by R. N. Conwell, Public Service Electric & Gas Co.

"Rubber Glove Testing Practices," by R. W. Chadbourn and W. H. Meade, Boston Edison Co.

"Power Arcover Damages Overhead Line Conductors," by Geo. H. Matthews, Detroit Edison Co.

The meetings on May 8 were under the sponsorship of the Overhead Distribution Group, the Plant Coordination Group and the Overhead Transmission Group. Mr. F. E. Sanford of the Cincinnati Gas & Electric Co. presented a paper on "Transformer Maintenance Coordinated with Loading Practices" and Mr. Myron Zucker of the Detroit Edison Co. presented a paper entitled "X-Ray Inspection of Electric Utility Poles." This was accompanied by lantern slides illustrating the inspection method described by Mr. Zucker. The Plant Coordination Group part of this program was devoted mainly to an explanation of the status of various activities with which this group is concerned. No papers or formal discussions were presented.

The program sponsored by the Overhead Transmission Group consisted of a Transmission Line Operating Report by Mr. Edwin Hansson of the Pennsylvania Water and Power Co. and a Protective Tube Operating Report by Mr. D. M. Bunn of the Northern States Power Co.

Following this scheduled program was a session devoted to round table

discussions of various subjects such as specifications for wood poles, untreated fir crossarms, treatment of wood crossarms and the rebuilding of transformers.

A dinner meeting of all committees was held on the evening of May 7 at which there was an interesting address entitled "The Magnetic Storm of March 24 and its Effect on Power and Communication Systems" by Mr. A. G. McNish of the Department of Terrestrial Magnetism of Carnegie Institute. In connection with this address, brief discussions were given Mr. W. F. Davidson of the Consolidated Edison Co. of New York, Inc., on the effects of this magnetic storm in the power system, and by Mr. E. W. Germaine, General Superintendent, Western Area, Long Lines, American Telephone & Telegraph Co., on the effect of this storm in the communication system.

This meeting of the Transmission and Distribution Committee was well attended and excellent interest was shown in all parts of the program. It was tentatively decided that the next meeting of the committee would be held in Atlanta, Georgia during the week of October 14.

Prime Movers Committee Meeting

By E. L. Hopping, *Chairman*

THE spring meeting of the Prime Movers Committee was held at the Edgewater Beach Hotel on May 6 and 7 in conjunction with the meetings of the other engineering committees of the Institute.

Mr. H. C. Miller reported that the Power Station Chemistry Subcommittee had nearly completed its report for the current year and that this report should be available in the early summer. Mr. Miller also outlined the plans of the committee for next year.

The Turbine Subcommittee, according to Mr. G. C. Daniels, has about completed its annual report. This year the subcommittee has devoted considerable attention to condensers and this discussion will occupy a considerable portion of the report.

The Boilers and Combustion Subcommittee's activities were reported by Mr. J. F. Muir. This subcommittee has been very active and a comprehensive report covering recent developments is nearing completion.

Mr. John Drabelle reported that the Oil and Gas Engine Subcommittee was planning to compile new data relating to these prime movers, which it is expected will be of great value to the power sales engineer.

The recently organized Boiler Auxiliary Subcommittee made a progress report of its activities and its plans for the coming year. Under Mr. Engle's direction this new subcommittee has been studying the problems within its assignment, and expects to have many interesting features to report to the committee next year.

The Metallurgical Subcommittee under Mr. H. N. Boetcher reported satisfactory progress on its assignment. In addition, it was reported that a very satisfactory meeting had recently been held of the Boiler Code and Power Station Piping Code, where efforts are being made on the matters of uniform rules for piping design.

A very interesting round table discussion was conducted under the direction of Mr. J. A. Keeth. The committee at this session was able to clear up all questions which had been submitted for discussion.

Mr. F. T. Hague, Engineering Manager of the Westinghouse Electric and Manufacturing Company, South Philadelphia Works, assisted by Mr. R. P. Kroon, Research Engineer, presented an interesting paper to the committee members and to members of the other engineering committees. Mr. Hague gave a description of the investigation of stresses in impulse blading which has been carried on in the South Philadelphia Works of the Westinghouse Company, and in the Schuylkill Plant of the Philadelphia Electric Company. A 10,000 kw development turbine has been operating under various conditions of load in the Schuylkill plant. This paper brought out many points which have been learned in this careful and thorough research, both in the factory and in an operating power station. At the meeting a demonstration was given of some of the new factors which have been learned. This work is being continued and Mr. Hague promised to keep the electrical industry fully advised of all developments as they are worked out.

Tentative plans were announced to hold the next meeting of the committee in Pittsburgh on October 6 and 7, 1940.

New Distribution Transformer Standards Continue to Draw Active Geographic Interest

GEOGRAPHIC presentations and discussions of the new E.E.I.-N.E.M.A. Standards for Distribution Transformers are continuing actively. Since the news item in the April BULLETIN, the Joint Committee report and exhibit have been put on in Indianapolis on May 10 by the Indiana Electrical Association, also by the Empire State Gas & Electric Association in New York City on May 17. This brings to a total of 13, thus far, the separate localities in which the report and exhibit have been presented with local cooperation. The standardized mechanical features, which carry principal emphasis in the exhibit, and particularly simplified mounting direct to the pole, continue to attract leading attention.

Through the medium of these local presentations, a large number of utility engineers have gained firsthand familiarity with the standardized features and with the advantages to be gained therefrom. These engineers have been prompted to study their respective situations for adapting practices to realize these benefits as promptly as practicable when the new standards become commercially available, which is scheduled to begin next July.

Dancing Conductors

By R. N. Conwell

Public Service Electric and Gas Company, Newark, N. J.

A paper presented at a joint meeting of the Accident Prevention Committee, Electrical Equipment Committee and Transmission and Distribution Committee, EEI, May 7, 1940 at Chicago, Ill.

ON Wednesday, Feb. 14, 1940, weather conditions were such that a light glaze of irregular cross-section formed on the wires which, together with a transverse wind, resulted in the phenomenon known as "dancing" or "galloping" conductors. Although the condition continued throughout the day it was most severe during the morning hours at which time all of the tripouts were recorded. Two areas were affected, one in and around Metuchen Switching Station and the other in the Meadows, both subjected to a clean sweep of the wind. Both, also, are important from a service viewpoint since much of the output of Essex, Kearny and Marion Stations is routed by 132-kv transmission on the Meadows, and Metuchen Switching Station is an important switching center in addition to being the major supply for a part of the Central Division.

Undoubtedly, some of you have had experiences similar to the one which is reported but fortunately for us these phenomena only occur at rare intervals. The only excuse for this paper is the hope that some constructive suggestions may result from the discussion.

Weather Conditions

General weather conditions on Feb. 13, 1940 were unusual and caused the Newark *Evening News* of that date to run a headline over their weather map saying "Sunny February Days That Stir Thoughts of Spring." The highest temperature registered was 47 deg. F. at 4:01 P. M. and the lowest temperature was 39 deg. F. at 7:30 P. M. In its general weather comment this paper made the following observations:

"Chilly blasts struck in New York State this morning and the resulting squalls took the form of some snow and some rain, the latter proving that warm air was still circulating in the upper levels as the cooler air flowed along the surface. *The rain glazed the highways in and around Buffalo and Rochester.* The Government forecast is based on *a strong likelihood that New Jersey will get a similar dose.*"

On Wednesday, Feb. 14, 1940, these predictions came true. A light rain began at 4:20 A. M. and at 4:35 the Newark Airport weather station observed a light rain at 31 deg. F. with a 16-mile wind from the east-northeast. At 5:35, the temperature had increased to 32 deg. F. but the precipitation was observed as light freezing rain and the wind had increased to 20 miles an hour. The wind gradually increased in velocity to a maximum observed of 39 miles an hour from the east-northeast at 11:35 and the precipitation changed from a combination of light sleet and light freezing rain to moderate sleet and light snow. From this time on, the temperature decreased steadily to 17 deg. at 5:35 P. M. A heavy snow fell throughout the afternoon while the wind varied in velocity between 30 and 24 miles an hour and the direction swung almost steadily from the east-northeast through northeast to north.

Since the temperature zone in which glaze forms on wires or other structures is very narrow, it was undoubtedly fortunate that the temperature decreased on that day. The weather bureau observation of light freezing rain from 5:35 A. M. to 10:35 A. M. agrees very closely with reports from our own organization. All observations indicate that the glaze formation on wires was very slight, estimates ranging from ⅛ to ¼ inch. It is to be noted that at the time when our transmission system was in the greatest trouble, judged by line tripouts, the wind was in the east-northeast or northeast and that the velocity ranged from 24 to 39 miles per hour. In the afternoon the wind velocity remained in approximately the same range, 24 to 30 miles per hour, but the swing in direction to the north seemed to decrease the amplitude of the movements in conductors. In fact, none of the circuits most critically affected experienced any tripouts after 12:28 P. M.

Detailed weather data from Newark Airport are shown in Table I.

System Conditions

On Feb. 14, the electric system was in normal operating condition, the only work scheduled which required line outages being 13-kv feeder work at Marion Switch House.

The 132-kv ring system connecting the Meadows generation with Roseland and Metuchen was in service as well as the line to Trenton and all interconnections.

Line Design

The 132-kv transmission circuits have been erected on three general designs of towers with two types of conductor. The original tower lines connecting Essex, Kearny, Marion, Athenia, Roseland, West Orange and Metuchen were designed for an 800-foot average span and the tower top provides 13 feet of vertical separation between cross-arms with a 3-foot horizontal offset outward of the middle conductor. The lines connecting the Meadows generating stations and the Kearny-Athenia line as far as the Harrison Turnpike use 500,000 circular mil copper conductor strung to 5000 lbs. tension under heavy loading conditions. The remainder of the Kearny-Athenia line and all other lines with the design of tower mentioned above use a 795,000 circular mil ACSR conductor strung to 7500 lbs. under heavy loading. The Metuchen-Trenton tower line is designed for 500-foot average span and the tower top provides 13 feet vertical separation with a 2-foot one-inch horizontal offset outward of the middle conductor. The conductors of this tower line are 795,000 circular mil ACSR strung to a tension of 10,000 lbs. under heavy loading.

The more recently constructed lines, including the Essex-Metuchen line which was involved in the trouble of Feb. 14, provide 14 feet vertical separation with a 2½-foot horizontal offset outward of the middle conductor. The line is strung with 795,000 circular mil ACSR to 10,000 lbs. under heavy loading conditions.

The 26-kv wood pole transmission system utilizes 250,000 circular mil copper

TABLE I—WEATHER DATA—NEWARK AIRPORT, FEB. 14, 1940

Time	Temperature °F.	Precipitation	Wind Direction	Wind Velocity Mi. per Hr.
1:35 A.M.	32		ENE	18
2:35 A.M.	31		ENE	24
3:35 A.M.	32		ENE	17
4:20 A.M.		Light rain begins		
4:35 A.M.	31	Light rain	ENE	16
5:35 A.M.	32	Light freezing rain	ENE	20
6:35 A.M.	32	Light freezing rain	ENE	24
7:35 A.M.	32	Light sleet—Light freezing rain	ENE	34
8:35 A.M.	32	Light sleet—Light snow—Light freezing rain	ENE	26+
9:35 A.M.	32	Light sleet—Light snow—Light freezing rain	ENE	27+
10:35 A.M.	31	Light freezing rain	NE	27+
11:35 A.M.	32	Moderate sleet—Light snow	ENE	39
12:35 P.M.	30	Heavy snow—Light sleet	NNE	30+
1:35 P.M.	29	Heavy snow—Light sleet	NE	27
2:35 P.M.	29	Heavy snow	NNE	26+
3:35 P.M.	28	Heavy snow	NNE	29+
4:35 P.M.	27	Heavy snow	NNE	24+
5:35 P.M.	17	Heavy snow	N	25+

All directions of wind refer to True North. Note that the wind varied from east-northeast through northeast to north during the daylight hours.

strung to a maximum tension of 2000 lbs. under heavy loading. Two pole-top configurations are used, one a 36-inch delta for span lengths up to approximately 150 feet and a vertical configuration with 4 feet between crossarms and an 18-inch horizontal offset outward of the middle conductor. This latter type of pole top has been used for spans up to approximately 300 feet.

The 4-kv distribution system utilizes copper conductors throughout strung to a maximum tension under heavy loading conditions equal to one-half of the ultimate strength of the conductor with 2000 lbs. as a maximum. The space between pins is 12 inches and, in some cases, adjacent pins are used and, in others, the practice was followed of skipping the middle pin on each side of the cross-arm, resulting in a 24-inch separation between wires rather than the normal 12. There is some feeling that the 24-inch spacing is preferable.

Report of Trouble

As previously mentioned, the trouble seemed to be concentrated in two areas; one, around Metuchen Switching Station, and the other in the Newark Meadows. The freezing rain and wind seemed to have formed the proper conditions for dancing in the Metuchen area before similar troubles appeared farther north. Beginning at 6:24 A. M. when the first Roseland-Metuchen tripout occurred, the trouble both at 132 and 26-kv piled up rapidly. Around 8:00 A. M. the 26-kv lines in the Central Division began to get into trouble and from this time on there were many observations and reports of dancing conductors. By that time, observations were also made of dancing in the Newark Meadows area although the first tripout in this section did not occur until 9:14 when the Kearny-Athenia tower line led off the parade. From that time until noon the trouble was general in both areas.

The observations from both areas affected seem to agree that the ice deposit on the conductors was very light. As observed from wires down, from fences, and from other structures the thickness of ice was reported to vary from ⅛ to ¼ of an inch. In some cases, the glaze was lighter than the ⅛-inch figure mentioned but no cases were reported of heavy ice deposits.

Tables II and III show the number of circuit outages due to dancing conductors divided into two classes, 132 and 26, respectively. It is to be noted that Essex-Metuchen 132-kv circuit tripped out a total of 18 times, closely followed by Roseland-Metuchen circuit with 15 times. Other 132-kv circuits tripped 8, 7, 3, 2 and one times, respectively.

On the 26-kv system, the greatest number of tripouts occurred on a Hudson-Hackensack circuit which tripped 18 times and was nearly matched by a Hudson-Rutherford circuit which tripped out a total of 17 times. These two circuits are on the same pole line through the Secaucus area. A Carteret-Tremley circuit tripped 6 times and other circuits tripped a lesser number of times.

The 4-kv system was comparatively free from trouble when consideration is given to the tremendous number of circuits exposed. Of a total of 9 distribution circuit outages during this day, only 6 were due to open-wire troubles. Furthermore, of these 6, 3 circuits in Rutherford, Haddon Heights, and Monmouth Junction reported wires down without any dancing conductors having been noticed. Two circuits, Plank Road 4008 and North Arlington 4005, reported wires down due to dancing conductors and one circuit, Fort Lee 4009, was interrupted by dancing conductors without burning down wires. Again it is to be noted that this list of trouble in the 4-kv system is very brief.

Observations on Dancing Conductors

Our observations of the detailed conditions under which conductors danced and the manner in which the conductors moved do not seem to differ from those reported in the technical literature. This is a phenomenon which results from an ice glaze of irregular cross-section on the wires and an exposure to a transverse wind. Since the glaze formation of irregular cross-section causes the wire to lose its cylindrical shape and approach an air foil it can be lifted or depressed by any wind with a transverse component. The glaze on the conductors was irregular in shape and the wind velocity varied from 24 to 39 miles per hour. At all cases where violent dancing was observed, the wind was transverse to the line or at least had a considerable transverse component and the observed angles between direction of the wind and the direction of the line varied from 30° to 90°. These data agree closely with reports from other sources.

The nature of the movement of the wire varied between a complete arching of the conductor from one point of support to another which might be referred to as a negative or upward sag observed on some wood poles to a wave motion on the conductors of the steel tower lines. Here a violent uplift would start near one point of support, at times augmented by the swing-in of the suspension insulator, and this hump or wave would travel to the far end of the span and in some cases would be reflected back into the originating span and would also be transmitted into the neighboring span. There was no synchronism observed between conductors of different phases or in different spans. It was noticed that one conductor might move down at the same time at which a lower conductor moved up and that contact would be made from this combined motion. In general, the

TABLE II—132-KV TRANSMISSION CIRCUIT OUTAGES

Circuit	Terminal	Mfgrs. Rating* Mva	Duty Mva (Max.)	Number Tripouts	Tripouts Per Hour°
C-1303	Kearny	2,500	1900	1	.2
	Athenia	1,750	2050	1	.2
D-1304	Kearny	2,500	1900	2	.3
	Athenia	1,750	2050	1	.2
O-1315	Roseland	2,500	2400	7	3.5
	Metuchen	2,500	2400	5	2.5
P-1316	Roseland	2,500	2400	15	4.3
	Metuchen	2,500	2400	10	2.9
Q-1317	Metuchen	2,500	2500	3	.8
	Trenton	2,500	1500	2	.5
R-1318	Metuchen	2,500	2500	7	1.5
	Trenton	2,500	1500	5	1.0
W-1323	Essex	2,500	2400	18+	3.3
	Metuchen	2,500	2100	4	.7
			Total	81	

* 2 minute basis.
° Time for each line taken as elapsed time from first to last tripout on the 132-kv system reduced by time the individual line was held out.
+ 3 operations on spare breaker.

ground wires were relatively free from movement.

The short span wood pole construction seemed to show action of a span length as a whole rather than the traveling of a wave down the span. On a long span wood pole line the traveling wave phenomenon appeared as on the higher voltage construction.

An unusual circumstance of this storm was the violent dancing of an aerial cable of the telephone company. This aerial cable is erected along the Belleville Turnpike and was in violent movement throughout a great portion of the day.

Physical Damage

During the daylight hours when conductors were dancing so violently, the only physical damage on the 132-kv system which required immediate repairs was one case of a wire burned down on Roseland-Metuchen 0-1315 circuit. Inspection of the 132-kv tower lines at a later date indicated that the damage was slight. It has been necessary to replace conductors at 9 locations, to replace one cross-arm complete, to replace some insulators which had worn hardware, to tighten cross-arms at 15 locations, to install 4 conductor repair sleeves, and to cut out burns and install compression joints at 10 locations. The cross-arm replaced was removed because of excessive wear at bolt holes caused by the wrenching of the cross-arm. In some cases nuts on the bolts holding the attachment plate at the end of the cross-arm had a very considerable portion of their cross-section removed due to the continued movement of the insulator strings. None of the work of replacing conductors was necessary on Essex-Metuchen W-1323 circuit which is equipped with fast pilot wire relaying and fast oil circuit breakers.

On the wood pole 26-kv transmission construction the experiences differed greatly. The Belleville Turnpike pole line in the *Essex Division*, which had been dancing violently all day, suffered mostly from general mechanical abuse. The trouble seemed to start with the breaking of through-bolts holding cross-arms or with the backing off of the nuts on these through-bolts. Fifteen bolts were found broken and in 15 additional cases, the nuts were completely missing on cross-arm through-bolts. It was necessary to replace 15 cross-arms, one being cracked at the through-bolt, one being burned due to a broken insulator, and 13 were split. The damage to insulators was minor, one being broken and 21 being chipped, while nuts were missing from 3 insulator pins. The 4-kv construction on this same pole line suffered mostly from broken insulator pins, there being approximately 100 cases, and from broken lag bolts and broken bolts on cross-arm braces. In addition, there were 8 tie wires broken and at two different locations taps were broken off.

This list of wood pole trouble in the Essex Division differs greatly from that experienced in Central and Hudson Divisions. In *Central Division* all 26-kv lines were inspected immediately after the storm and the only damage found was the loss of 3 lag screws and one damaged pothead. A distribution circuit out of Bound Brook danced violently and suffered from general damage but remained in service throughout the storm. The *Hudson Division* transmission lines were reported to be dancing violently throughout the morning and these circuits showed the largest number of tripouts on the 26-kv system. Physical damage, however, consisted of only one broken insulator in which case the thimble broke out of the cement and allowed the insulator to thrash around with the conductor. This small amount of trouble was undoubtedly influenced by the fact that this line had received its regular pole top inspection and tightening during the week preceding the storm.

The 132-kv system experienced a total

TABLE III—26-KV TRANSMISSION CIRCUIT OUTAGES
(Due to Dancing Cables Only)

Circuit	Terminal	Mfrs. Ratings* Mva	Duty Mva (Max.)	Number Tripouts	Tripouts Per Hour°
R-70	Hudson	1,500	700	4	1.3
	Rutherford	1,000	230	4	1.3
W-75	Hudson	1,500	700	1	.4
	No. Arlington	750	250	2	.8
M-273	Hudson	1,500	700	17	3.4
	Rutherford	1,000	230	14	2.8
N-274	Hudson	1,500	700	18	3.6
	Hackensack	750	290	15	3.0
O-353	Hudson	1,500	700	4	.8
	Hackensack	750	290	4	.8
E-187	Metuchen	1,500	870	1	1.3
	Bound Brook	400	180	3	4.0
P-198	Carteret	750	410	6	4.7
	Tremley	1,000	360	1	.8
T-228	Metuchen	1,500	870	3	.6
	Cranford	750	180	1	.2
U-229	Metuchen	1,500	870	1	.2
	Cranford	750	180	1	.2
J-244	Metuchen	1,500	1000	4	1.5
	Rahway	750	290	1	.4
			Total	105	

* 2 minute basis.
° Time for each line taken as elapsed time from first to last tripout on the 26-kv system reduced by the time the individual line was held out.

of 81 oil circuit breaker tripping operations, the largest number for any single-line terminal being at the Essex end of the Metuchen-Essex line. This breaker, rated by the manufacturer at 2,500,000 kva, operated successfully 4 times at duties between a minimum of 900,000 kva and a maximum of 2,300,000, assuming that it opened after the other terminal breaker had opened. Following these operations a bus tie breaker was closed at Kearny which increased the duties on the breaker to a range of between 1,000,000 kva and 2,600,000 kva. At this higher duty the breaker operated successfully 11 times after which it was closed and failed to latch. A spare breaker of the same rating was substituted which operated 3 times under the same conditions.

A later examination of these 2 breakers showed that both had suffered considerable internal mechanical damage and both had developed leaky bushings. Other 132-kv breakers operated 15, 10, 7, 5, and 4 times, respectively, and when inspected were found to be in good condition although none of these breakers had been subjected to the high duty which was characteristic of the Essex breaker. With the exception of the 2 Essex breakers, no deterioration of the oil or contacts was noted on inspection. Still other breakers operating a smaller number of times have not been inspected and no such inspection is planned.

The oil circuit breakers on the 26-kv system turned in a performance which was equally satisfactory. Of a total of 105 oil circuit breaker tripping operations, those on the Hudson-Hackensack lines tripped 18 and 15 times, respectively, and those on the Hudson-Rutherford lines tripped 17 and 14 times, respectively. Other breakers tripped 6 times or less during the storm. Upon inspection, all of these breakers were found to be in excellent condition with the exception of the breaker at the Hackensack terminal of one of the Hudson-Hackensack lines which had 15 tripping operations recorded during the storm in addition to 15 tripping operations since the last maintenance period. The contacts were found to be satisfactory but the dielectric strength of the oil was down to 20 kv. In general, we consider the performance of the oil circuit breakers as highly satisfactory since, with the exception of one location where the rated duty cycle was probably exceeded, there was no unusual maintenance of the breakers required.

Service Record

Due to the fact that the conductors on the 3 tower lines connected to Metuchen Switching Station were "dancing," circuit outages overlapped 7 times, shutting down Metuchen for a total of 19 minutes and resulting in an interruption to all substations supplied from this source. During a period of approximately 1 hour when Metuchen was supplied from Trenton the 26-kv bus voltage at Metuchen varied from 20.5 kv to 25.5 kv.

There were no interruptions in the Bergen Division, although of the 6 transmission pole line routes to this area, 2 double circuit pole lines were affected throughout the daylight hours by "dancing" conductors and a third was in trouble for a shorter time.

The 4-kv distribution system showed a remarkable record for performance. There were only 6 circuit outages due to open wire trouble and in one of these cases all the load was subsequently cut over to other circuits.

Overvoltages on the System

A portion of the Metuchen-Cranford 26-kv circuits is constructed on the Roseland-Metuchen tower line right of way and both of these 26-kv circuits and the two 132-kv circuits were reported "dancing." The clearances between these lines were designed for steady-state conditions. It is believed that the 132-kv and 26-kv lines came in contact resulting in the failure of No. 3-phase lightning arresters on the transformer banks at the Somerville Substation. An examination of the oscillograms taken at Metuchen shows that a 132-kv phase-to-phase fault existed for some cycles with intervals of 132-kv phase-to-ground current followed by a period of approximately 1 second during which the 26-kv neutral ground current was at times twice normal and the 26-kv to ground voltage was 2½ times normal. Bad burning on the gaps and in the valve sections of the lightning arresters which failed bears out this theory.

The Essex-Metuchen 132-kv circuit is made up of approximately 9 miles of 132-kv cable from Essex Station to Bayway where it is joined to approximately 12 miles of steel tower construction to Metuchen. This cable has a charging current of approximately 35,000 kva. During the day of the storm this circuit was switched a total of 19 times and these operations were performed without any difficulty being experienced as the result.

Conclusions

1. The infrequent occurrence of the phenomenon of "dancing conductors" precludes the economic possibility of reconstructing lines to minimize the hazards.

2. On double circuit tower lines, occupied by one circuit, additional spacing may be secured by utilizing the top and bottom arms on one side of the tower and the middle arm on the other side. With a normal 13-foot vertical spacing between arms this would provide ample clearance on 800-foot spans between conductors when dancing occurs.

3. As a temporary expedient, some relief might be obtained on double circuit lines, either tower or wood pole, by opening three disconnects at both ends of the line (B phase of one circuit and A and C phases of the other), thus forming a new circuit with increased clearances between line conductors.

4. In those areas where dancing is prevalent, some method of electrically loading the lines may be required to melt the glaze or prevent its formation.

World's Fair Exhibits

(*Continued from page* 220)

minutes the action-packed story of a 24-hour period in the city's life.

The entrance hall of this building, too, has been enlivened by four new displays, presenting in animated, three-dimensional form the material underlying the Consolidated Edison companies' annual report to customers. In one of these, armored trucks, laden with utilities tax money, roll from New York to Albany and Washington. A second group of animated displays is dominated by a heroic figure of the "Edison Man," newly executed in brass, copper and duralumin. The 9,000 square-foot water wall and water ballet again form the building facade as seen from the Plaza of Light.

The exhibit of another Consolidated Edison System company, the Consolidated Telegraph and Electrical Subway Company, dramatizes New York's present underground system of electric distribution in contrast to the old "overhead forest" system. In the Power—Electrical and Steam building, Consolidated Edison has joined with General Electric Company and Westinghouse Electric and Manufacturing Company in an exhibit portraying the history of light from the caveman's stone lamps to the fluorescence of today.

The Joint Corrosion Committee for Electrolysis Mitigation

By M. W. Ghen
Duquesne Light Company

A paper presented at a meeting of the Transmission and Distribution Committee, E.E.I., Chicago, May 6, 1940

THE cable operating engineer who would reduce the number of failures on his lead-covered cables to a minimum would do well to scrutinize closely the possibility of damage from corrosion and stray current electrolysis. If this statement is doubted, a close study of the National Cable Operation reports for the last few years will confirm it.

The years 1937 and 1938 show failures from these causes to be 25.2 per cent and 24.3 per cent respectively of the total service and test failures occurring on cables operating at 7.6-66 kv as reported to the Electrical Testing Laboratories. How many of the breakdowns attributed to stray current electrolysis occurred in active "positive" areas and how many were the result of old conditions where full corrective steps have been taken, it is impossible to state. Nevertheless, corrosion failures from all causes constitute a large part of the total cable failures and demand the attention of the cable operator.

Metallic substructures buried in the earth may be subjected to a number of sources of corrosion. Most frequent of these sources are "stray current" electrolysis, soil action, and local galvanic action between dissimilar metals in a suitable electrolyte. Because the substructures of a number of different agencies must, of necessity, occupy common ground beneath the streets and highways, there are numerous locations where they share in common the conditions mentioned.

Probably the most serious of these conditions is the one involving "stray currents" from street railways or other external sources of direct current flow in the earth. Because street railway systems usually use the rail as a return path, and the rail structure is in contact with earth, current flows through the rail and also the earth in parallel with it. Any conducting substructure buried in this earth may also offer a return path for current.

When such is the case it becomes necessary to take mitigative steps to prevent damage to the substructure in areas where the current leaves it (usually in the vicinity of the power source). Similar mitigative steps may be taken to clear other sources of corrosion. Such steps taken on the part of one company to protect its substructures can, and often do, result in intensification of the damage to other substructures in the vicinity.

After such corrective measures have been taken by one company, it is possible for a second company, working independently, to adopt further measures to protect its own plant, which may completely undo the work of the first and, in addition, create further unfavorable conditions for any remaining substructures in the area. Such a procedure must inevitably result in tremendous economic waste and frequent failure of substructures, especially when lead-covered cables are involved.

For several years, a number of large metropolitan areas have seen fit to handle their corrosion problems—and particularly "stray current" electrolysis—by means of joint committees established for this purpose. These committees are usually composed of members representing both privately and publicly-owned substructures. Organization of such a committee for the Pittsburgh district was accomplished in 1932, the Committee being known as the Corrosion Committee, a sub-committee of the Pittsburgh Public Service Co-ordination Committee.

The Corrosion Committee consists of a chairman and a secretary appointed by the parent committee, and members selected by the various agencies operating underground structures in the district. Meetings are held every two months, or more often if required, and usually follow a luncheon which gives the members an opportunity to become acquainted, as well as to participate in informal discussions.

At the meeting, each member is given a chance to bring before the Committee any corrosion problems with which he is concerned. Where necessary, maps and data relative to the case in hand are furnished by the interested parties. Records of trolley systems, positive and negative feeders, drainage connections, equalization ties, or any other pertinent information are maintained by the representative of the local street railways company and are available to all the members.

Individual problems are assigned to sub-committees usually composed of representatives specifically concerned with the problem at hand. The chairman of these sub-committees are responsible for co-ordination of the work and arrangements for necessary meetings in the field. The Committee as a whole owns no equipment or instruments except those owned by the individual companies. The co-operative action on the part of the individual companies, particularly those which are well supplied with instruments, has provided ample equipment for the proper measuring of potential drops and current flows.

Early in the life of the Committee, a review of mitigative methods revealed the use of two fundamental systems of protection in the district. The first was the "direct drainage" type, and the second was the "extended negative." These were later supplemented by a third system, really a modification of the first, and known as the "rail resistor" type. In order to make this paper complete, a brief review of "stray current" mitigation methods is necessary in spite of the fact that most cable operators are familiar with them.

Figure 1 indicates a typical condition as found in the vicinity of a direct-current railway substation where mitigative measures have not been applied. Under this condition, current leaves the rails at points distant from the station, flows through the ground to an adjacent substructure, along the substructure to the vicinity of the substation, and thence back through the ground to the rails and negative bus. The so-called "positive area" is that area in which current leaves the substructure, sometimes causing damage due to electrolysis.

In the case of direct drainage, copper drainage cables are connected from the

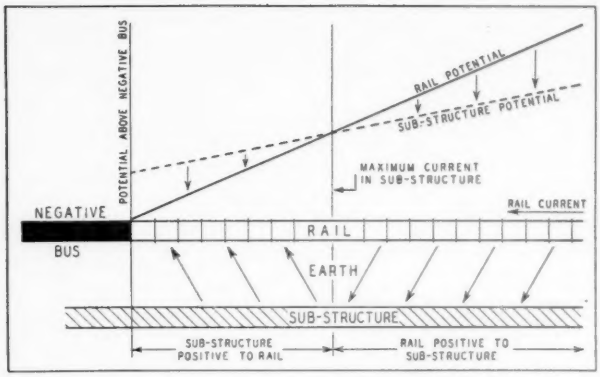


Fig. 1—No Sub-Structure Drainage

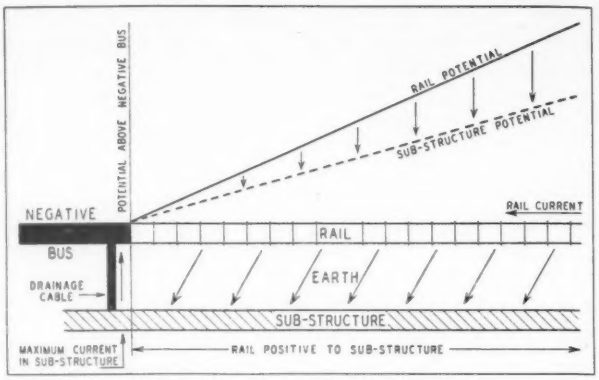


Fig. 2—Direct Drainage System

substructure to be protected to the station negative bus in an attempt to change the direction of current flow between substructure and rail in the positive area, as shown in Figure 2. Actually, there must always be some voltage drop through this tie connection, so that unless adequate copper is used the potential of the point of connection to the substructure may be slightly above the rail connection at the station. In some cases, particularly near stations where soil is of high resistance, this condition is acceptable. In the case of large stations, considerable copper may be necessary to bring the substructure potential below the track potential and provide complete protection. Even when this condition is established, it may be difficult to eliminate the effect of unequal potentials between various substructures in close proximity to each other. It is also difficult to establish proper potentials between substructures and rails where geographical layouts are not symmetrical and substructures do not follow strictly parallel paths.

The extended negative system, as shown in Figure 3, consists of a number of negative return cables paralleling the rails and tapping them at predetermined points. Each return also drains a portion of the paralleling substructure at a point closer to the station than its rail tie, thus providing a preferential drop to a section of the substructure.

The extended negative system has the advantage of providing drainage at a number of points and thus keeping the amount of current flow in the substructure at any particular location to a minimum. Its disadvantages are its high cost and the difficulty of designing for geographically unsymmetrical systems involving substructures crossing two or more rail lines. It is apt to be sensitive to changes in car loading schedules and require adjustments from time to time for that reason.

As a result of a review of the two systems described above, a third system employing a negative resistor between the rail and the negative bus was considered and has gradually been used to a considerable extent. This system, known as the "negative resistor" or "rail resistor" type, is in reality a modification or extension of the "direct drainage" type. Reference to Figure 4 will show that the negative resistor increases the rail potential above ground and insures a definite current flow toward substructures in the vicinity of the substation, thus protecting substructures in that locality. The resistor employed usually provides a drop of one volt per 1000 amperes.

The "rail resistor" scheme has the advantage of low cost and provides, in general, a greater margin of positive protection in the vicinity of the substation. Topography of the substation area, street layouts, etc., influence greatly the general arrangement of drainage cables employed with this system. Often it is only necessary to tap the substructures at one point in the immediate vicinity of the station; but in some cases, additional drainage points have been provided. Generally speaking, this system raises the potential of the rail and surrounding earth to the point where all structures are picking up current in the station area, making cross bonding unnecessary except to equalize potentials of substructures in extremely close proximity to each other.

This system does, of course, result in "forcing" a certain amount of additional current to return through the protected substructures. In no case, however, has the amount of current been sufficiently high to consider the de-rating of power cables or cause damage to any normal

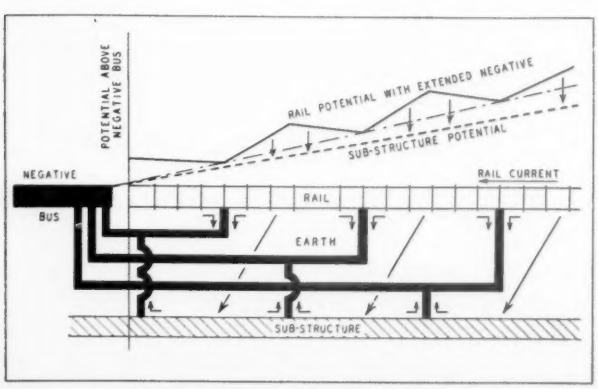


Fig. 3—Extended Negative System

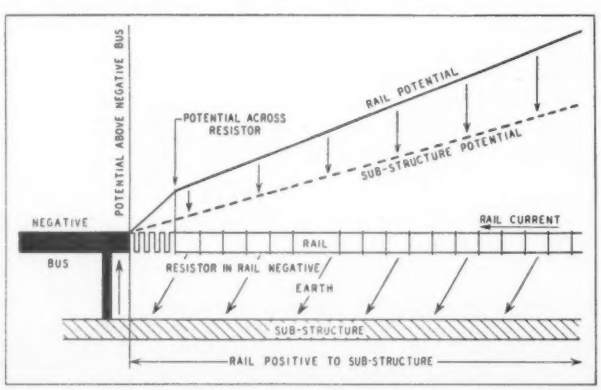


Fig. 4—Rail Resistor Method

substructure. Gas companies opening lines use clamps attached to flexible copper leads to bridge the point to be opened, a precaution which should be observed regardless of the mitigation system in use.

Pittsburgh is a city of bridges which span its three famous rivers as well as many valleys throughout the district. Early in the work of the Corrosion Committee, it was found that contacts between rail and substructures on these bridges were the source of a number of "positive areas" which were resulting in severe damage to substructures. Most of the bridges are of steel and provided a means of electrical connection between the street railway rails and attached substructures, which raised the substructure potentials to rail potential at this point. Current picked up through these connections flowed along the substructures in the areas adjacent to the bridge ends, through the surrounding earth to other structures of lower potential which were not attached to the bridge, causing excessive local damage. Conditions resulting from such contacts are indicated in Figure 5.

As a result of this condition, a large amount of work was done to insulate the substructures throughout the district from bridges carrying street car rails. Partly as a result of this activity and the elimination of other chance connections between rails and substructures, it was possible during the first year of the Committee's operation to correct positive potential conditions involving plant valued in excess of two millions of dollars.

Numerous devices and supplementary methods have been used in the solution of special problems. The simplest of these is the employment of cross bonding between substructures to eliminate purely local sources of trouble caused by close proximity of substructures of different potentials.

Cathodic protection has been used in one case where the particular structure involved was positive to earth in a rural area. In this case, three rails were driven vertically into the ground and used as an anode. The source of current in this case was a coal mine track system to which connection was not economical.

One negative booster installation has been in successful operation for some time. In this case, due to geographical conditions, it was not economical to install sufficiently large copper to secure the desired drainage. A small copper wire with a voltage applied by a motor-generator set produced the desired results at much lower overall costs.

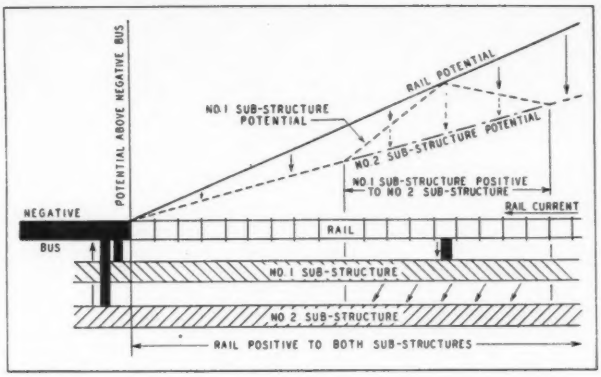


Fig. 5—Effect of Accidental Rail to Sub-Structure Contact

Many manual and automatic switches are used to disconnect substructures from negative station buses and, in some cases, from each other during periods of "off peak" station shutdown.

Soil action, fortunately, has been responsible for very little damage in the district with the possible exception of the older gas lines operating in acid soils. River water, often high in acid content, has been responsible for some corrosion on pipe line crossings. In one case, cathodic protection on a rather large scale has been employed to protect a multiple pipe gas line river crossing. Cinder fills have also been the cause of some corrosion. Galvanic action between dissimilar metals in suitable soils has been the source of some trouble to one company.

For protection, it is the practice of most pipe line operators to employ suitable bituminous compound coatings and wrappings in areas where bad soil or galvanic conditions are known to exist. In one severe case of cable sheath corrosion, due to galvanic action between copper ground plates and lead sheaths in a cinder fill, protected sheath cable has been employed. A second similar case of much smaller magnitude was corrected by breaking the external short-circuiting path with a very small amount of suitable insulation.

In general, it is realized, from the experience of others, that substructures in an area in which a street railway operates in conjunction with an adequate mitigation system receive a considerable amount of cathodic protection from the positive rails. This fact probably accounts for the small amount of unusual soil corrosion troubles experienced in the Pittsburgh district.

Condition and design of the track structure are of extreme importance in keeping the amount of "stray" current to a minimum. Latest type of heavy rails with welded joints providing high capacity return circuits and a monolithic type of track construction having relatively high resistance to earth have done much in recent years to aid in the solution of "stray" current electrolysis problems. Improved street surfaces which tend to keep moisture from entering the ground have also helped to some extent.

The mitigation of electrolysis and corrosion damage to underground substructures usually requires the efforts of experienced engineers who are not only able to understand the conditions affecting their own particular facilities, but must also appreciate the operating problems of the other subsurface facility operators. In the past, insufficient or irrelevant data such as potential difference readings between structures were accepted as being indicative of either hazardous or safe operating condition, and considerable sums of money were expended to eliminate so-called positive areas when in reality the earth potential gradient was such that the potential of the substructure to surrounding earth may have been either neutral or negative polarity. The problem of correcting conditions which may be causing damage to subsurface structures must be recognized as being quite involved, and it would be a fallacy at this time to assume that all factors affecting this problem are known. The co-ordinated effort of the technicians and engineers intimately associated with this problem in the various companies affected should result in the elimination of unnecessary expenditures and in the greatest overall improvement in the reduction of the amount of damage resulting from stray railway current electrolysis.

Resuscitation Review Board is Appointed

AT the recent meeting of the Accident Prevention Committee in Chicago on May 8th, W. R. Smith, Chairman of the Accident Prevention Committee, announced the appointment of a Resuscitation Review Board whose objectives will be to further study the effects of electric shock, the possibilities of resuscitation under varying conditions, and the comparative effectiveness of resuscitation procedure.

The work of the Review Board will require the cooperation of all utility companies in reporting electrical shock cases. The personnel of the Review Board as initially formed includes:

Dr. H. B. Williams, Dalton Professor of Physiology, Columbia University.

Dr. Cecil K. Drinker, Dean and Professor of Physiology, Harvard University.

Dr. W. B. Kouwenhoven, Dean of School of Engineering, The Johns Hopkins University.

Dr. C. H. Watson, Medical Director of American Telephone and Telegraph Company, New York.

Dr. Hart E. Fisher, Chairman of Health Committee, Public Utility Section, National Safety Council.

Dr. Yandell Henderson, Laboratory of Applied Physiology, Yale University.

Dr. R. R. Sayers, United States Public Health Service, Washington.

Mr. H. F. Webb, Chairman of Subcommittee on Artificial Respiration, Pennsylvania Electric Association.

Mr. E. W. Oesterreich, General Superintendent of Distribution, Duquesne Light Company.

Mr. Wills Maclachlan, Consulting Engineer, Toronto, Canada.

Mr. Ralph A. Bloomsburg, Niagara Hudson Power Corporation, Albany.

Mr. A. B. Campbell, Secretary, Accident Prevention Committee.

Mr. W. R. Smith, Chairman, Accident Prevention Committee.

The purpose for which the Board has been created, the objectives of its work, and the general procedure under which this work will be carried on are presented in the following outline.

EDISON ELECTRIC INSTITUTE ACCIDENT PREVENTION COMMITTEE RESUSCITATION REVIEW BOARD

Purpose

To receive and review reports on electric shock cases which will be submitted to the Board through channels and under procedure established by the Accident Prevention Committee of the Edison Electric Institute.

Objective of Review Procedure

To determine out of a study of the details of electric shock cases whatever may be indicated that has bearing on any of the following aspects of this matter:

(a) The physiological effects of electric shock on the human body.

(b) The possibility of resuscitation under varying conditions.

(c) The effectiveness of resuscitation procedure, both of the conventional prone pressure technique of the Schafer method and of the modified form of this method known as "Pole Top Resuscitation," which makes possible efforts of resuscitation while the victim of shock is either on a pole or in any other position where he cannot readily be placed in a prone position.

Procedure

(A) Reports of all cases of electric shock will be sought by the Accident Prevention Committee from all sources from which these may come. Those from whom assistance in this regard is anticipated, and will be especially solicited, are:

(a) Members of the Accident Prevention Committee and all other technical committees of the Institute who are requested not only to report cases in their own companies but to see that reports are sent in on any cases of which they learn, whether occurring on properties of Institute member companies, on properties of other companies within the electric light and power industry, in industry generally, or elsewhere.

(b) All electric associations; and solicitation will be through their accident prevention committees or committees on resuscitation if they have such. Otherwise, from the association secretary.

(c) National Safety Council.

(d) Any other sources from which reports may be obtained.

(B) Reports are to be sent in duplicate to A. B. Campbell, Secretary, Accident Prevention Committee, Edison Electric Institute, 420 Lexington Avenue, New York, New York. One copy will be promptly sent to the Chairman of the Resuscitation Review Board and copies made therefrom to the members of the Board with any comments that may be pertinent. With such copies will go comment forms for reply by members.

(C) Members of the Board will return their comments to the Secretary of the Resuscitation Review Board, by whom they will be tabulated and information therefrom prepared for the Chairman as may be desired for discussion at meetings of the Board and ultimately for use in connection with the reports of the Chairman to the Chairman of the Accident Prevention Committee. When additional information is desired by the Board or any member, the Secretary of the Board will proceed to obtain it in whatever may be the best way under the circumstances.

(D) Meetings of the Board will be held as called by the Chairman and the Chairman and Secretary of the Accident Prevention Committee will be ex-officio members of the Board and will attend the Board meetings.

(E) Except as may be especially asked for by the Chairman of the Accident Prevention Committee, reports on the results of the Board's studies need be made no oftener than quarterly. The Chairman of the Review Board may, however, make a report at any time that he considers desirable.

Field Report Form

Report Form "A" (to be available shortly) is to be used for furnishing to the Review Board the information considered desirable for the purposes of its study.

It will be noted that the name of the person shocked is not required. As each report is received it will be given a code number which will be identified with the name of the person responsible for sending the case in and, should any additional information be subsequently desired, that person will be communicated with and requested to supply it.

In view of the importance of certain details of the report to an understanding of the nature and effects of the shock it is urged that an effort be made by all of those who desire to aid in this investigation to get data that is as accurate as possible and to this end to develop in the minds of those who may have occasion to supply information, an understanding of the importance of apparently trivial details. Great assistance can be rendered by a careful observance of symptoms—as called for in Section III of Report Form "A".

The following message is addressed by Chairman Smith to all member companies:

"On behalf of the Accident Prevention Committee, it is my privilege to bring to your attention the subject which the foregoing announcement concerns and to solicit your fullest cooperation with our committee and the Resuscitation Review Board in the investigation which we propose to carry on. Happily we have evidence of the fact that relatively few electric shock cases are occurring in the industry at the present time because of thoroughgoing precautionary measures and constantly improving work practices. However, factual data on electric shock and its physiological effects can be of inestimable value to the industry, the medical profession, and all others concerned with this matter. The extent and character of the data which will be furnished to the Board and upon which alone for the most part will its work depend will be

(*Continued on page* 248)

Testing Rubber Gloves with High Voltage D-C

By R. W. Chadbourn and W. H. Meade

Laboratory Section, Engineering Department, Boston Edison Company

Presented by W. B. ELMER, Boston Edison Company, before a joint meeting of the Accident Prevention Committee, Electrical Equipment Committee, and Transmission and Distribution Committee, EEI, at Chicago, Ill., May 7, 1940

Conclusions

1. The present high voltage a-c test in common use for rubber glove testing is of very little value in locating minor mechanical defects in the gloves.
2. A-c leakage measurements are of little value in detecting mechanical defects.
3. D-c high voltage testing of rubber gloves is not injurious to the gloves.
4. D-c high voltage testing of rubber gloves is preferable to a critical visual inspection of the gloves for routine purposes, because it will provide a more uniform and therefore safer inspection equivalent.
5. D-c testing is more economical than a visual inspection of equivalent severity.
6. When a routine d-c test is adopted, the value of continuing the standard a-c test becomes questionable.

IT has long been recognized that a routine test of 10,000 volts a-c, made at intervals determined by the character of the service, is not, in itself, a completely satisfactory check on the condition of linemen's rubber gloves used on distribution circuits. For years, the Boston Edison Company has laid stress on a *careful visual inspection* and has considered the 10,000 volt a-c test to be a final check on the glove inspectors. Chief reliance on visual inspection has many disadvantages, the more serious of which are:

1. Unless men are alternated frequently between glove inspection and other types of work, the inspection becomes extremely tedious. As a result, it is difficult, if not impossible, for a man to maintain continuously a uniform standard of judgment.
2. Due to the impossibility of setting up an inspection standard which different inspectors can follow consistently, the inspection requirements must be made very rigid.

Because of these difficulties, the Boston Edison Company for many years pursued the policy of fairly frequent rotation of inspectors and unusually rigid inspection requirements. Besides believing that the 10,000-volt test alone could not be depended upon to pick out all defects which might develop into hazards, it was also believed that defects could not be satisfactorily classified as major and minor, or serious and trivial, merely by inspection of the part of the defect exposed to view. Gloves were accordingly rejected for *all* visible defects, major and minor. This policy, of course, resulted in an unusually high percentage of rejection. Out of 23,174 gloves submitted, 5888 or over 25 per cent were condemned to this procedure, but the accident hazard was reduced to a minimum. It was recognized that many of the gloves rejected actually would have been acceptable for further service, but unless a more satisfactory test and inspection procedure could be devised, it was considered undesirable to risk lowering the factor of safety.

The idea of increasing the voltage test was therefore entertained. The first tests were made with higher a-c test voltages, but it was soon discovered that there was a very poor correspondence between the mechanical defect and the electrical puncture.

Experience in testing other rubber products, notably rubber-insulated cable, had shown that high voltage d-c is more effective in picking out incipient faults than high voltage a-c. It was thought that the use of high voltage d-c for testing rubber gloves might be so successful in picking out incipient weaknesses in the gloves that some of those being condemned by inspection for the very minor flaws could be reclaimed for further use without any decrease in the factor of safety.

Description of Tests

For a preliminary investigation, a number of gloves were selected from a large group that had been condemned by inspection. From these were excluded those having very glaring faults. The first step consisted in subjecting a number of the remaining gloves, chosen at random, to the usual 10,000-volt a-c test, then raising the voltage slowly to breakdown. These results are shown in Table I.

Analyzing these results, we found that out of thirty-six gloves subjected to the test only two failures were obtained through the defects for which they had been condemned by inspection. Six of the other gloves flashed over and 28 failed through some spot where no defect was noticeable. The defects through which failure did occur were very serious, extending practically through the rubber. It was concluded, as a result of these tests, that a-c high potential tests, regardless of the magnitude of applied voltage, are of little value in locating moderate mechanical defects in rubber gloves.

The next step in the investigation was to make a similar set of tests using d-c instead of a-c. The results of this set of tests are shown in Table II.

In this series, eleven gloves which had been condemned by visual inspection were tested. It will be noted that the condemning defects are classed as "major" or "minor," on the judgment of the inspector. In general, the minor defects are very slight flaws or injuries apparently confined to the surface of the glove which place the glove on the borderline between acceptance and rejection, but which for conservative reasons, had been rejected in the past. Subsequent tests will show that the inspectors judgment of "major" or "minor" is not uniform or dependable. In this series of tests, ten of the eleven gloves failed, and all but two of the ten failed through the defect for which they were condemned on physical inspection. The two gloves that did not fail through the defect were examined very closely to ascertain the cause of failure. Glove No. 3900 which failed at 25 kv, a comparatively low voltage, and glove No. 2941 did not contain any noticeable defect at the point of failure. Thickness measurements were made on glove No. 2941 showing it to be thinner at the point of puncture than at the base of the condemning defect.

The suggestive results obtained on this preliminary test prompted another series of a similar nature. In these tests, however, the water levels were lowered in order to increase the flashover voltage of the gloves. The results of this series, given in Table III, were similar to those of the preceding set in that the failures obtained occurred through the defect for which they had been condemned.

TABLE I

Glove No.	60-Cycle-Kv Breakdown	Condemning Defect	Failure Location	Notes
48	26.5	Cracks on fingers & sides	Side of cuff	Not at defect
156	37.5	Cracks on side		Flashover
618	34.0	Cracks on fingers & sides	Tip of 2d finger	Not at defect
1071	30.5	Cracks on fingers & sides	Thumb	" " "
1245	34.0	Pit on 2d & back of hand	Thumb	" " "
1462	24.5	Cracks on fingers	Palm	" " "
1675	22.5	Pit on palm	3d finger	" " "
1994	33.0	Pit on 1st finger	Thumb	" " "
2037	30.0	Pits on thumb & 4th finger		Flashover
2057	32.0	Pit on cuff		"
2060	26.5	Pit on cuff, 2d & 4th fingers	4th finger	Not at defect
2203	29.0	Cracks on fingers	Palm	" " "
2203	24.5	Cracks on fingers	Cuff	" " "
2362	31.2	Cut on thumb	1st finger	" " "
2544	29.0	Cracks on fingers	Palm	" " "
2924	24.2	Cut on 2d finger	Palm	" " "
2983	29.5	Pit on back of hand	4th finger	" " "
3131	30.0	Cracks on side	Cuff	" " "
3147	36.0	Cracks on side	2d finger	" " "
3408	30.5	Cut on thumb	Cuff	" " "
3461	36.0	Cracks on fingers		Flashover
3494*	21.5	Cut on thumb	Thumb	Through defect
3560	32.0	Pit on side	4th finger	Not at defect
3581*	28.5	Cuts on 1st finger	1st finger	Through defect
3588	28.5	Pit on thumb		Flashover
3658	36.0	Pit on 2d finger	Thumb	Not at defect
3794	33.0	Pit on 2d finger		Flashover
3842	32.0	Cut on thumb	Thumb	Not at defect
3861	24.5	Pit on cuff	Cuff	" " "
4048	32.5	Cracks on 1st, pit on 4th	3d finger	" " "
7665	29.5	Cracks on fingers & side	Thumb	" " "
8724	30.0	Pits on palm & 2nd finger	Thumb	" " "
9331	28.5	Pits on thumb & 1st finger	Cuff	" " "
9736	22.5	Cracks on fingers & side	Thumb	" " "
9911	32.5	Cuts on 2d finger	Thumb	" " "
9994	31.5	Cuts on thumb & 1st finger	1st finger	" " "

* Very deep cuts.

An interesting point developed in these tests: Glove No. 870, which was condemned for what was considered a major defect, flashed over at 54 kv, while glove No. 1042, which was condemned for what was considered a minor defect, punctured at 19.0 kv—an abnormally low voltage. This strongly demonstrates the great difficulty in differentiating positively between major and minor defects by visual inspection.

The gloves that flashed over on this test were then subjected to long time tests. Twenty-five thousand volts d-c were applied for five minutes and the voltage increased 5 kv every five minutes until breakdown occurred.

The results of these tests were rather mystifying in that only two gloves failed through the defects for which they were condemned. In an effort to explain this, measurements of glove thickness were made in the vicinity of the defect and also in the vicinity of the failure. In every case the rubber thickness near the point of failure was less than that in the vicinity of the condemning defect. See Table IV.

In some cases the difference was slight, but it was always in the same direction. It is also interesting to note that the rubber thickness in the vicinity of the failures of the two gloves that failed through the defect was somewhat thinner than that near defects in any of the other gloves. It is also true that the rubber thickness of these two gloves at the point of failure is of the same order as the thickness of the other gloves at the point of failure.

The next step in the investigation of the d-c high potential test was to make repeated short-time breakdown tests on several defective gloves until failure occurred or until 10 applications had been completed. A two-minute rest was allowed between applications of 50 kv d-c, the voltage being applied at zero and slowly raised to the full value. See Table V.

The interesting point in these results is the fact that of three gloves judged to have major defects all failed through these spots, while of 11 containing so-called minor defects 7 failed through other parts of the glove, 1 failed through the minor defect, and 3 did not fail. It is of interest to note in this connection that in Table II, of seven gloves tested which had minor defects, five failed through the defects.

The gloves which did not fail on this test were subjected to long-time d-c high potential tests by applying 30 kv for five minutes and increasing the voltage 5000 volts every five minutes until breakdown occurred. Without exception, the gloves failed eventually at some spot other than that for which they were condemned.

The results of this series of tests using d-c high potential convinced us that the use of d-c for making high potential tests on rubber gloves would be a step in the right direction, since defects which present even the slightest actual hazard will be picked out whether the hazards are visible or invisible. In support of this conclusion is our knowledge that a-c test failures in rubber cables usually occur at points which do not appear to be the weakest spots. Very frequently these

TABLE II

Glove No.	D-c Kv Breakdown	Condemning Defect	Class of Defect	Failure Location	Notes
112	40.0	Cut on 1st finger	Major	1st finger	Through defect
757	40.0	Ozone cracks on fingers and side	Minor		Flashover
Retest	40.0				"
Retest	40.0				"
2207	40.0	Thumb crotch wrinkled	Minor	Thumb	At defect
2853	38.0	Abrasion between 2d & 3rd finger	Minor	Crotch 2d	" "
2941*	34.0	Cracks on 2d finger	Minor	2d finger	Not at defect
3086	38.0	Pits on back of 1st finger	Minor	1st finger	At defect
3092	36.0	Cut on palm & 2nd finger	Minor	2d finger	Through defect
3132	38.0	Cut on thumb & 2d		Thumb	" "
3900**	25.0	Cut on 2d, pit on thumb & 1st	Major	2d finger	Not at defect
8614	39.0	Cut on thumb	Minor	Thumb	Through defect
9489	39.0	Pit on palm, cracks on fingers	Major	1st finger	" "

* Thickness at puncture 48.5 mils; thickness at defect 55.0 mils.
** Glove #3900 apparently contained a serious defect that was not discernible as indicated by the abnormal low voltage at which breakdown occurred.

failures occurred through what appeared to be the thickest part of the insulation wall.

The question was then raised as to whether application of a high d-c stress injures the gloves. To determine this, six gloves were immersed in water, and numerous one-minute applications of 50 kv d-c were made at 3-minute intervals on four of them. After each application of d-c the power factor was measured. At intervals, the power factor of the other two gloves was determined. Of the six gloves, 1 and 2, 3 and 4, and 5 and 6 were similar. Gloves 2 and 5 were not energized with d-c. All the gloves showed an increase in power factor, and it is of interest to note that the rate of increase was the same for corresponding gloves of the same pair, although one was subjected to d-c and the other was not. At the conclusion of the d-c tests, two gloves which had not punctured were dried out for two days, and a final power factor test made. In both cases, the power factor was almost exactly the same as at the beginning of the tests. These and additional tests indicated that, so long as the gloves are immersed in water, the power factor shows a gradual increase, caused by gradual absorption of water, but that the application of repeated unidirectional stresses has negligible effect upon the power factor. It was concluded, therefore, that the gloves were undamaged by the application of high voltage d-c up to the limit of the experimental values.

One requirement of a rubber glove is that it shall not pass an excessive leakage or charging current to a lineman's hand when both inside and outside are wet, as during wet weather. The a-c leakage measurement is of value in checking this requirement. As an indicator of mechanical defects, however, a-c leakage measurements are probably valueless. A-c leakage values are, roughly, functions of the glove thickness and of the s/c of the rubber, and in phase or watt component is blanketed by the charging current. D-c leakage values are, roughly, functions of the glove thickness and the resistivity of the rubber, and are about one one-thousandth of the a-c leakage values. Whether d-c leakage readings will satisfactorily serve the object of a-c readings cannot yet be stated.

D-c leakage measurements were made on a group of gloves which were subsequently subjected to 10 repeated applications of approximately 50 kv d-c, in the same manner as heretofore, until breakdown occurred. The leakage current

TABLE III

Glove No.	D-c Kv Breakdown	Condemning Defect	Class of Defect	Failure Location	Notes
870	54.0	Cracks on 2nd finger	Major		Flashover
1042	19.0	Cracks on cuff	Minor	Cuff	Through defect
1277	53.0	Abrasion on 1st finger	Minor		Flashover
1624	54.0	Abrasion on thumb	Major		"
1695	54.0	Cracks on fingers	Minor		"
2400	53.0	Cracks on fingers	Minor		"
2454	43.0	Cut on 1st finger	Major	1st finger	Through defect
2506	52.0	Cuts on thumb	Minor	Thumb	" "
2835	54.0	Pit on 3rd finger	Minor		Flashover
3069	54.0	Abrasion on cuff	Minor		"
3091	52.0	Pit on 3rd finger	Minor		"
3143	54.0	Cut on 1st finger	Minor		"
3179	52.0	Cracks on fingers	Minor		"
3498	53.0	Abrasion on thumb	Minor		"
3745	49.0	Abrasion on palm	Minor		"
3753	54.0	Abrasion on cuff	Minor		"
3634	33.0	Cut on 3rd finger	Major	3rd finger	Through defect
3663	53.0	Cracks on fingers	Minor		Flashover
3829	53.0	Pit on 2nd finger	Minor		"
3908	54.0	Abrasion on 3rd finger	Minor		"
9294	43.0	Abrasion on cuff	Major	Cuff	Through defect
9562	53.0	Cracks on palm	Major		Flashover
9782	52.0	Cut on thumb	Major	Thumb	Through defect
9805	55.0	Cracks on fingers	Minor		Flashover

TABLE IV

Glove No.	D-c Kv Breakdown	Failure Location	Notes	Thickness At Failure	Thickness At Defect
870	30.0 at 4:25	Thumb	Not at defect	.0365	.0465
1277	40.0 at 1:02	4th finger	" " "	.0445	.0470
1624	40.0 at 1:10	2nd finger	" " "	.0450	.0475
1695	40.0 at 1:14	Thumb	" " "	.0285	.0470
2400	40.0 at 4:18	4th finger	" " "	.0460	.0515
2835	45.0 at 2:47	Cuff	" " "	....	....
3069			Flashover		
3091	35.0 to 2:42	Thumb	Not at defect	.0390	.0495
3143	50.0 at 0:28	Thumb	" " "	.0405	.0500
3179	45.0 at 0:09	2nd finger	Through defect		.0425
3498			Flashover		
3745	50.0 at 0:37	2nd finger	Through defect		.0405
3908			Flashover		
9562	40.0 at 0:45	Thumb	Not at defect	.0350	.0480
9805	25.0 at 1:07	1st finger	" " "	.0425	.065
A	50.0 at 1:40	Thumb	New glove	....	
B	50.0 at 0:44	Thumb	" "	....	

TABLE V

Glove No.	D-c Kv Tests Break-down	of 50 Kv D-c	Condemning Defect	Class of Defect	Failure Location	Notes
43-4	48.0	2	Cracks on cuff	Minor	Thumb	Not at defect
56-1	50.0	8	Abrasion on cuff	Minor	Crotch 1st & 2nd	" " "
1498	50.0	4	Cuts on thumb & cuff	Major	Thumb	Through defect
1660	...	10	Oil spots	Minor		Withstood 10 cycles
1889	48.0	1	Cuts on fingers, thumb, & cuff	Minor	Thumb	At defect
2754	50.0	4	Cuts on cuff	Minor	1st finger	Not at defect
2908	50.0	0	Cut on 1st finger	Minor	Thumb	" " "
3891	30.0	0	Cuts	Major	Palm	Through defect
4144	...	10	Cuts & oil spots	Minor		Withstood 10 cycles
4173	50.0	2	Cuts on fingers & cuff	Minor	1st finger	Not at defect
4365	50.0	5	Oil spots	Major	Palm	Through defect
4367	...	10	Oil spots	Minor		Withstood 10 cycles
9237	45.0	2	Cuts on cuff & 2nd finger	Minor	Thumb	Not at defect
9784	50.0	6	Cut on cuff	Minor	Thumb	" " "

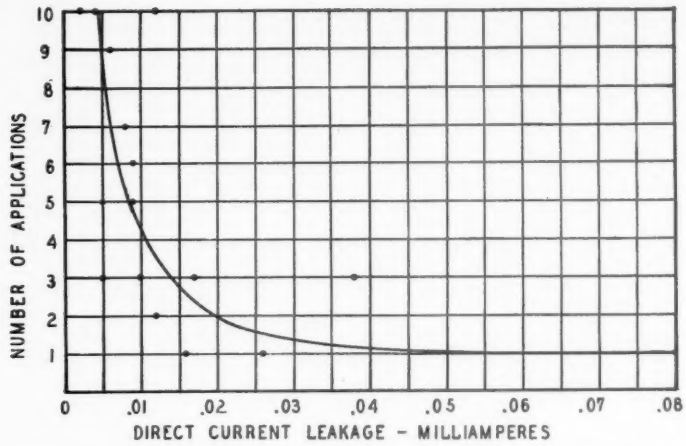


Fig. 1—Relation Between D-C Leakage and Breakdown Obtained With Repeated Applications of High Voltage D-C Measurements Made at 30 kv., Maximum Voltage 50 kv.

values plotted against the number of applications of potential, present a rather interesting study. All of these gloves had been condemned previously on inspection. (See Fig. 1.)

TABLE VI

Glove No.	Leakage in Milliamperes Start	Final				
43-3	.010	.012	at	3rd	cycle	
56-1	.006	.009	at	9th	"	
1498	.005	.007	at	5th	"	
1660	.004	.005	at	10th	"	
1889	.012	.013	at	2d	"	
2754	.009	.009	at	5th	"	
2908	.080	...	at	1st	"	failed 50 kv
3891	.026	...	at	1st	"	failed 30 kv
4144	.012	.018	at	10th	"	
4173	.005	.006	at	3rd	"	
4365	.009	.009	at	6th	"	
4367	.002	.005	at	10th	"	
9237	.017	.020	at	3rd	"	
9784	.008	.011	at	7th	"	
9893	.016	...	at	1st	"	
582	.038	.038	at	3rd	"	

In Table VI it is interesting to note that glove No. 2908 which had an abnormally high leakage failed on the first applications. Glove No. 3891 which had the third highest leakage also failed on the first cycle. Glove No. 2908 had an initial leakage current of .08 milliampere and failed at 50 kv at a point other than the defect for which it was condemned, while glove No. 3891 having an initial leakage of .026 milliampere failed at 30 kv through the defect for which it was condemned.

The results shown here indicate roughly that the leakage current varies inversely with the number of applications of 50 kv which the gloves will withstand. This leads us to suspect that with sufficient data we might possibly be able to assign limits of d-c leakage at some voltage that might assist in judging the condition of the glove.

The results obtained in the foregoing investigation prompted us to transfer our attention to production testing of rubber gloves. The testing equipment was revised to provide for high voltage d-c tests as well as the usual a-c high potential test. Four different routines were followed in the remainder of the investigation as outlined below.

Routine #1

This routine was applied to a group of 390 gloves which had been condemned previously but saved pending development of the d-c testing technique. The gloves were first given a rigid visual inspection and the location and magnitude of all defects noted. The gloves which contained defects were subjected to a d-c high potential test. Voltage was applied at a low value and increased at the rate of 5 kv per second until 30 kv was reached. At this voltage leakage measurements were made. Voltage increase was continued until 45 kv was reached, and the voltage was held at this value for one minute and then removed. The usual a-c high potential test (10 kv for one minute) followed, and a-c leakage measurements were made at 10 kv.

Results

Total number of defective gloves tested	390
Number of gloves containing so-called major defects	133
Number of gloves containing so-called minor defects	257
Number of d-c breakdowns in gloves containing major defects	58
Number of d-c breakdowns in gloves containing minor defects	30
Total d-c breakdowns	88
Per cent breakdowns of total tested	22.6
Number of d-c failures through defects	68.0
Number of d-c failures through spots other than defects	20.0
Number of failures on a-c high potential	0
D-c breakdown of gloves containing major defects above the water line	32
D-c breakdown of gloves containing minor defects above the water line	24
D-c breakdown of gloves containing major defects below the water line	26
D-c breakdown of gloves containing minor defects below the water line	6

Of gloves that did not fail through the defect, many failed at a voltage so abnormally low that there is little doubt that defects existed at these spots that were not evident during visual inspection or upon examination of the breakdown.

The large number of breakdowns occurring through defects above the water line show that the cuffs, although not immersed in water, are subjected to an effective test, apparently of sufficient magnitude to eliminate any existing hazard.

The fact that no gloves failed on the a-c high potential test is highly significant as indicating that the d-c test had already eliminated gloves which would otherwise have failed on this test. A-c failures on gloves which pass the visual inspection have been rare, but a few a-c failures were to be expected on gloves containing mechanical defects.

The gloves which had been previously condemned for minor defects and which withstood both tests were returned to service.

Routine #2

This routine was applied to 427 more of the gloves which had previously been condemned but held pending the development of d-c testing. The gloves were first given a rigid visual inspection, and the location and magnitude of the defects noted. The gloves containing defects were subjected to the a-c high potential test (10-kv for one minute). A-c leakage current measurements were made at this voltage. The gloves were then subjected to a d-c high potential test as outlined in Routine No. 1. In other words, the order of tests was the reverse of that followed in Routine No. 1.

Results

Total number of gloves tested	427
Number of gloves failing on a-c test	30
Number of gloves failing on d-c test	55
Failures on a-c that occurred through condemning defects	18
Failures on d-c that occurred through condemning defects	47
Failures on a-c that did not occur through condemning defects	12
Failures on d-c that did not occur through condemning defects	8

Failures on a-c that occurred at 6 kv or below through the condemning defect	16
Failures on a-c that occurred above 6 kv through the condemning defect	2

The interesting points that developed in this series of tests follow.

Of the 30 gloves that failed on the a-c test, 18 of them broke down through the defect for which they had been condemned. These results were somewhat contrary to results previously obtained on this type of test, that is, the majority of the failures occurred through the defects for which they had been condemned. Closer analysis of the results showed, however, that, with two exceptions, all of the failures that occurred through the defect did so at voltages of 6 kv or less. The failures that occurred at voltages in excess of 6 kv did so at points other than the defects for which they were condemned.

Forty-one gloves which had been subjected to the 10 kv a-c test failed on the d-c test. Thirty-seven of these gloves failed through the defect for which they were condemned. This result indicated that the d-c test will pick flaws in gloves which are not detected by the a-c test, whereas the preceding routine showed that the reverse condition does not obtain.

Routine #3

Part A

Nineteen hundred eighty-seven gloves were subjected to the usual critical inspection. All gloves having major defects were condemned. Those having defects not classified as major, together with those which did not have any noticeable defects, were tested as follows. Ten thousand volts, a-c, were applied to the gloves for one minute, leakage current measurements being made at the end of this period. Gloves that survived this test were then subjected to 45 kv d-c for one minute. Leakage current measurements were made at 30 kv d-c. Gloves that survived both of these tests were approved for return to service.

Results

Total number of gloves submitted	1987
Number of gloves approved for return to service	1634
Number of gloves condemned	353
Number of gloves condemned by inspection	289
Number of gloves condemned by ac test	11
Number of gloves condemned by dc test	53
Per cent condemned of total submitted	17.8
Per cent returned to service	82.2
Per cent condemned by inspection	14.5
Per cent condemned by ac test	.6
Per cent condemned by dc test	2.7

Part B

A slight change was then adopted in this routine as follows. Nine hundred and thirty-one gloves were hurriedly inspected to eliminate those having exceptionally serious defects which consisted in most cases of holes entirely through the gloves. All gloves surviving this inspection were tested as above.

Results

Total number of gloves submitted	931
Number of gloves approved for return to service	779
Number of gloves condemned	152
Number of gloves condemned by inspection	71
Number of gloves condemned by ac test	25
Number of gloves condemned by dc test	56
Per cent condemned of total submitted	16.4
Per cent returned to service of total submitted	83.6
Per cent condemned by inspection	7.62
Per cent condemned by ac test	2.68
Per cent condemned by dc test	6.02

It is interesting to compare the results obtained by the two different methods. In Part A the percentage condemned by inspection was high, while the percentages condemned by the voltage tests were relatively low. In Part B the percentage condemned by inspection was considerably reduced, due to the speed-up of the inspection, but the percentages condemned by the voltage tests were correspondingly increased. The net percentages of gloves condemned by both methods are surprisingly close.

Routine #4

The gloves were subjected to a cursory examination and all having glaring defects were condemned. The surviving gloves were subjected to 45 kv d-c for one minute, holding the voltage at 30 kv long enough to make leakage measurements. The gloves that withstood this test were then subjected to 10 kv a-c for one minute. Leakage current measurements were made at the end of the minute. The gloves passing both voltage tests were approved for return to service.

Results

Number of gloves tested	5823
Number of gloves approved for return to service	4901
Number of gloves condemned by cursory inspection	595
Number of gloves condemned by dc high potential test	325
Number of gloves condemned by ac high potential test	2
Total number condemned	922
Per cent approved for return to service of total tested	84.17
Per cent condemned by cursory inspection of total tested	10.2
Per cent condemned by dc test	5.6
Per cent condemned by ac test	.03
Per cent condemned	15.8

The two gloves which failed on the a-c high potential test were examined very closely to ascertain if there was any visible evidence justifying the failures. No signs of any defects were found. One of the gloves punctured at 10 kv and the other at 7.5 kv a-c.

Of the 325 gloves which failed on the d-c high potential test, 227 failed through defects which were obvious on inspection after failure. Of the 98 gloves which failed through defects which were not obvious on the d-c high potential test, 84 failures occurred on the cuffs of the gloves.

Discussion

High voltage d-c testing has been added as a permanent routine test on rubber gloves. Adoption of high voltage d-c testing reduces tremendously the arduousness of inspection and results in a saving for further use of a large number of gloves previously condemned by inspection. An idea of the saving to the Boston Edison Company can be obtained from the following statistics on used glove testing:

Approximate number of gloves tested annually	10,000
Approximate number of gloves condemned annually before inauguration of dc test	2,540
Approximate number of gloves condemned annually since inauguration of dc test	1,580

The preceding figures are close approximations and indicate a saving of five hundred pairs of gloves per year or one glove in every 10 submitted for test. At present glove prices, this saving amounts to approximately $1,700 per year. An additional saving is also obtained in testing labor due to elimination of the critical inspection. This saving is estimated to be in the vicinity of $600 annually.

The savings realized by the Boston Edison Company are not necessarily representative of what can be expected in the way of savings by other companies. It is recognized that the Boston Edison Inspection procedure was originally more rigorous than that practiced by many companies, and for this reason a margin of saving existed which would not have been present had a more moderate inspection procedure been in force.

The former rigorous procedure was believed justified because of the importance of the task and the lack of any clearly defined line of rejection to which to work. The new d-c testing procedure provides such a line and at the same time preserves an exacting standard of safety. Moreover, it is believed that we have obtained a reduction in potential hazards that may have existed under the old procedure. Rubber glove hazards have been kept to a minimum by most users in general by careful inspection and test and close supervision of use. Regardless of the care with which a visual inspection is made, however, a definite human element enters into the procedure. At best, some defects may escape detection once in a great while. The d-c test, as applied, in effect provides an artificial inspection free from this human element, and, therefore, provides an improved safeguard to the users of the gloves.

"Edison the Man" Dramatizes Electric Light

ELECTRIC utility companies and appliance dealers all over the country will have an unusual opportunity for cooperative promotional campaigns during the next few months, following the release in May of "Edison the Man," new M-G-M motion-picture biography of the great electrical inventor. Starring Spencer Tracy in the title role, the film is a sequel to the recent "Young Tom Edison"; but it should afford much greater promotional possibilities because it portrays a portion of Thomas Edison's adult life—including the actual invention and first public use of the electric light.

The world premiere of the picture was held simultaneously in Orange, East Orange, West Orange, and South Orange, New Jersey, the night of May 16, climaxing three days of pageants, social functions and spectacular displays in these four communities, all of which are within a few miles of the old Menlo Park laboratories where the incandescent electric lamp came into being. The laboratories were reproduced in exact detail for "sets" in the production. As a feature of the celebration, the Public Service Company of New Jersey erected a battery of lights to create "the brightest spot on earth," and illuminated a huge photograph of Edison, described as the largest photograph in the world.

At the premiere itself Spencer Tracy and Rita Johnson, who plays Mrs. Edison, made personal appearances, along with Clarence Brown, the director, and John W. Considine, the producer. Members of the Edison family also were present.

Beginning with Edison's arrival in New York in search of financial backing, the picture-story proceeds quickly to the setting up of the laboratories at Menlo Park from which Edison's contributions to progress were to issue year after year, to a total of over 1,100 patents. The experimental work leading to the invention of the incandescent lamp is shown in some detail; and these scenes are successful in transmitting the feeling of arduous, but always exciting, struggle against financial pressure, the scoffing of other scientists and the failure of one material after another as "filament" (a word coined by Edison) for the proposed lamp. 9,000 of these actually were tested before Edison hit upon the happy combination of carbonized cotton thread and vacuum.

AND THERE WAS LIGHT—Thomas Edison (Spencer Tracy) finds triumph within his grasp

Easily the most dramatic scene is that of the group of Edison workers struck to awed silence as the lamp glows, becomes brighter and continues to burn through a "death watch" of forty hours during which the inventor and his aides never leave the room. Next to it, and possibly more impressive through implication, is the starting of the generators at the Pearl Street station in 1882, lighting the streets of downtown New York with what must have appeared dazzling brilliance to the Manhattanites of those days.

The life of the real Thomas Alva Edison is too nearly contemporaneous (he died in 1931) to permit the usual cinematic liberties with biographical facts, but the character has been humanized through brief sequences portraying his courtship, marriage, and subsequent family life, and through convincing scenes showing his friendship with his employees and their loyalty to him.

The main story of "Edison the Man" closes in 1882, when the inventor was 35 years old. He appears as an aged man only in short prologue and epilogue scenes showing him speaking at a celebration of Light's Golden Jubilee in 1929. And here the producer, it seems to the BULLETIN, missed a dramatic bet. Evidently with the present European war in the scenarial mind, the pictured Edison has been made to forebode the destructive forces which might come out of scientific research and invention. Unfairly, we believe, the intimation was that the scientists themselves would be the perpetrators of mass horror—rather than the political overlords who demand and force the twisting of the constructive products of genius into weapons of death.

Thomas Alva Edison was no pessimist concerning the social and economic achievements that science and industry might expect. His actual words at the Jubilee celebration are worth repeating once more. In part they were:

"I am proud of the electrical industry —of its vision, courage, zeal and devotion to public service; and I suspect every American feels the same way about it.

"It is a great reward to me and the many colleagues and co-workers, who, I rejoice to say, are still living, that we have survived to see the full fruit of our labors. The record is wonderful; but, fine as it is, it can be made still better and I have a feeling that in your hands it will be."

Portland General Electric Company Emergency Trouble Dispatching Network

By W. A. Leidigh, Jr.
Communication Engineer, P.G.E. Co.

AFTER complete study of available channel assignments and considerable development work, the space radio network of the Portland General Electric Company passed the construction permit stages on October 25, 1939, when the Federal Communications Commission authorized station license for fixed and mobile transmitters under the call letters of KQEB. On this date "Special Emergency" radio service became part of the company's communication system and the transmitters are now in regular service under full control of the Operating Department.

The company's distribution network covers approximately 3300 square miles and serves 136,000 customers. It is estimated that the electric service to at least 100,000 customers covering an area of 2500 square miles will benefit from the new radio communication system. Further expansion with addition of other fixed units under control of rural district offices will no doubt be the solution to complete and dependable coverage.

Fixed Transmitter

Being primarily interested in emergency trouble car dispatching and hydro plant contacts from the fixed station and finding congestion of other services on and near the "Special Emergency" channel 2726 K.C., the assignment at 2292 K.C. was chosen. The fixed transmitter is a composite locally built unit, crystal controlled and Class "B" modulated, with an output capability of 150 watts F.C.C. rating. The required 50 watts are maintained, however, due to the power limitation on the operating channel. Having complete control of transmitter design, tube replacement costs were considered. Popular low priced tubes were used with a total replacement cost of $47.00 for the entire transmitter unit.

A one-quarter wave vertical type radiator is supported by a 125-foot cedar pole set 12½ feet in the ground, and painted in accordance with the requirements of the aeronautics authority. An elaborate 36-wire radial ground system is used to increase radiation efficiency and produce beneficial low angle wave propagation. The transmitter is housed in a small wooden structure at the base of the pole, thus eliminating antenna feeder lines. Thermostatically controlled electric heat maintains room temperature at approximately 70 degrees Fahrenheit.

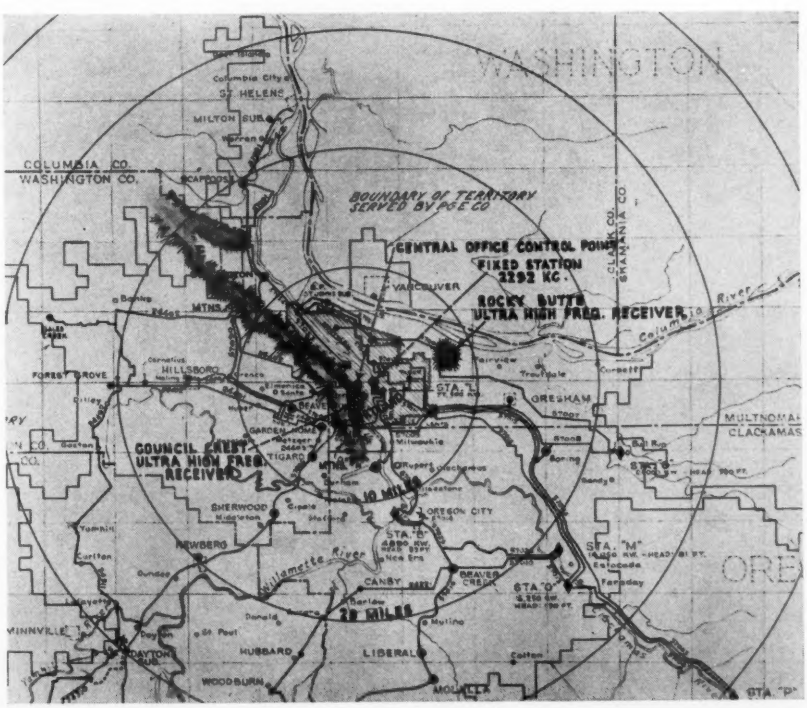
The station is entirely automatic and no operators are required at the transmitter. The control point is located in the central office building at the system load dispatcher's desk, a distance of one mile from the transmitter.

The voice input to the transmitter is equalized to permit only those frequencies producing maximum understandability to enter the modulation system. Such practice is general where high fidelity is not required and maximum coverage is demanded from a low power transmitter.

One-Way Tests, 2,292 K.C.

Construction permit tests under summer mid-day conditions showed satisfactory coverage of 40-mile radius to moving mobile units where power line disturbance was not excessive. Hydro plants with good receivers reported understandable signal strength at air line distances of 50 miles under same conditions. Similar tests conducted at night brought reports of much greater signal strength and increased range.

Dependable city-wide coverage is assured at any time, due to the central location of the transmitter and "received" signals are far above any noise level encountered.



System Map Showing Coverage Area of KQEB Radio Network, Portland General Electric Company

Mobile Receivers

At present, twelve emergency trouble cars are equipped with Philco 821-P crystal stabilized re-

ceivers and can be called from their routine work at the instant a breakdown occurs. Receivers with very high R.F. gain were tested but such gain proved unnecessary, except in remote locations, due to the signal to noise ratio at the average mobile receiving position. The "Q" or "squelch" circuit included in the Philco receivers with its "no signal" noise reduction has proved of great value to operators of mobile units in metropolitan areas.

Two-Way Mobile Units

Three two-way mobile units are now in operation and other emergency cars are being equipped. The transmitters operate on the special emergency channel of 31,740 K.C. One car of the coupe type contains a locally built type H, model 1-1B Radio Specialty Company ultra-high frequency transmitter with which all experimental work was done. Before selecting the transmitting equipment for other mobile units the Federal Communications Commission granted a 30-day test period, which was later extended to 60 days, authorizing comparison tests of mobile transmitters considered. The General Electric type G-1, model 4G1B1 unit gave such excellent performance in frequency stability and coverage range in a truck installation over the 60-day test period that such units were purchased and placed into regular service.

Both emergency trucks are equipped with one-quarter wave shunt fed vertical radiators that are erected, by mechanical means, from inside the cab. Tests proved that added height possible with this type of antenna decreased car body reflections and increased radiation efficiency.

Antenna and Transmitter Housing KQEB

All two-way car installations include an oversize battery (180-ampere hour, 20-minute rate) and special charging generator equipment, thus battery troubles have been eliminated and plenty of reserve power is available for long periods of emergency work.

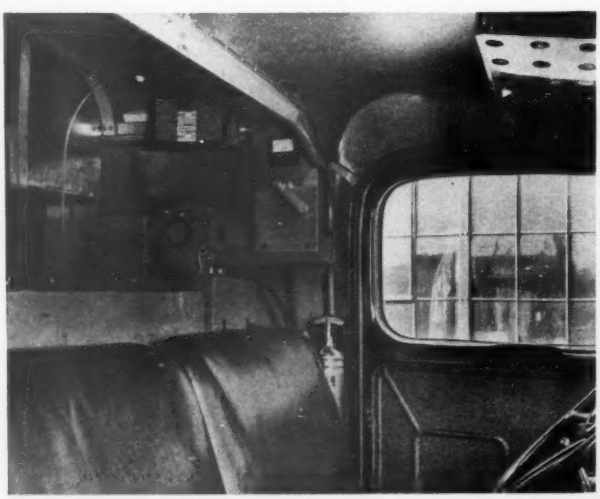
Fixed Ultra High Frequency Receivers

The fixed receiver for 31,740 K.C. consists of a Pearson Delane communications unit with locally built crystal stabilizer mounted in one rack. This receiver is located on Council Crest approximately 1200 feet above the surrounding country, and close to the center of the area to be covered. The audio output of the receiver is connected with the central office control point, via rented telephone lines.

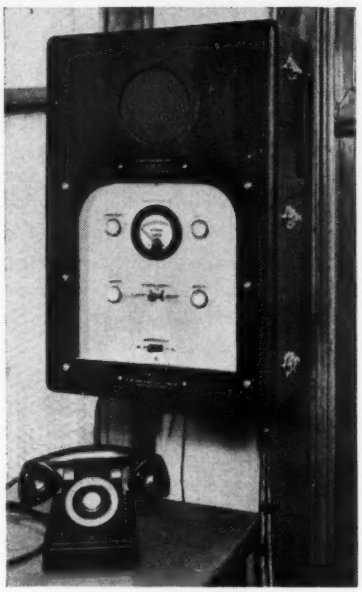
A second fixed ultra-high frequency receiver is now being installed at Rocky Butte, approximately 10 miles due east of the above location and 600 feet above the surrounding country. A 70-foot pole will support the one-quarter wave R.C.A. ground radial type antenna, and a concentric line will connect said antenna to a General Electric crystal stabilized ultra-high frequency receiver. The audio output will be mixed via telephone line with the audio output of the present receiver at the fixer transmitter location. Hill and mountain shadings will be minimized by the new receiving point, and in some locations, where spotty reflected mobile transmissions are now experienced, perfect sight range reception will be possible.

Maintenance and servicing problems are also simplified because the removal of one receiver does not completely dis-

Emergency Coupe Installation for Two-way Communication



Emergency Truck Installation for Two-way Communication



Central Office Control

rupt the radio network. The same is true if severe storm conditions, to which such locations are exposed, should completely disable one receiving unit.

The high volume so-called "rain static" that is received on ultra-high frequencies under certain atmospheric conditions is usually quite localized, and seldom affects both receivers at the same time. Thus, at least 80 per cent of the available "talk - back" coverage can be maintained if suitable line mixing facilities are installed.

Two-Way Tests 2,292 K.C. and 31,740 K.C.

During construction permit tests, with the experimental mobile unit and one fixed ultra-high frequency receiver, dependable two-way duplex conversations resulted over a radius of 16 to 20 miles in all directions. In some cases, over comparatively level country satisfactory contacts up to 50 miles were made. Hill and mountain shadings were observed which limited the ultra-high frequency talk-back in some localities, but the fixed station on 2292 K.C. was received by the mobile two-way unit practically free of dead spots in all locations where the car was within its transmitting range.

Operating Experience

The special emergency radio network has been in regular service only a short period, and no unusual storm conditions have been experienced. However, in several cases where strong winds caused many line failure outages on primary circuits and a number of transmission line interruptions involving loads up to 10,000 kw., normal service was restored from 30 to 45 minutes sooner when radio facilities were used. Obviously, the value of such service to a large number of customers should not be underestimated, but where line repairs require more time with heavy line crews the "time saved" percentage of the outage period is materially decreased.

In one case where a single span transmission line outage had interrupted the service to a hospital, the dispatcher was informed that two persons were on the operating table and restoration of service was imperative. Such service was restored by two well directed radio equipped cars in 35 minutes, where the usual switching time would have consumed more than one hour.

Where human life is involved and human errors can be instantly corrected by the recall of a switching order before it is executed, and experienced emergency crews can be speedily dispatched to locations where hot wires are down, any reasonable investment in radio equipment is certainly justified.

During the first five months of operation, an average of 41 calls per day originated from the fixed transmitter. Approximately one - half of these calls were network continuity tests with the remainder fulfilling the emergency requirements of the station license. The operating log shows a peak of 75 calls during one 24-hour period, and in several cases where storm conditions prevailed 60 to 65 calls were made. The fixed station transmission timer recorded from 1 to 3 hours operating time per week during normal conditions with a maximum of 4 hours during one week.

As closely as can be estimated at the present time, 95 per cent of all fixed station calls are completed.

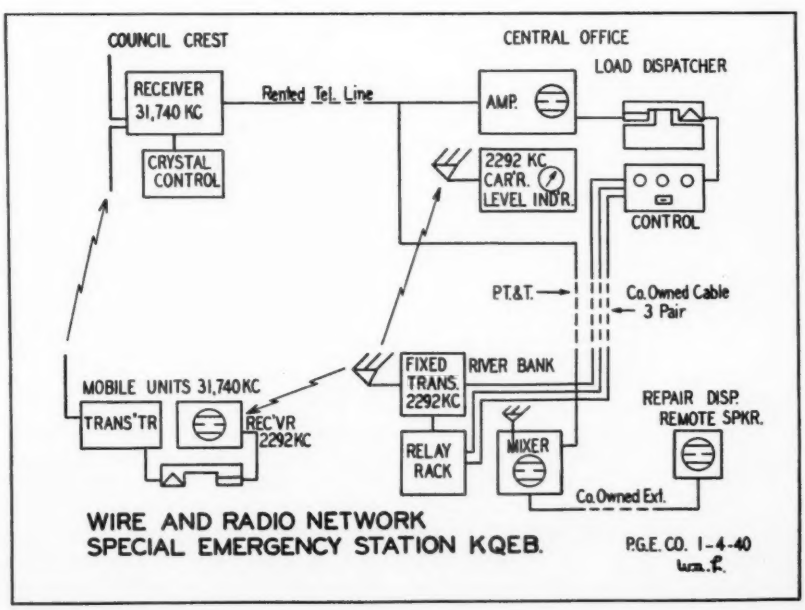
Maintenance

It is estimated that maintenance, periodical adjustments, and new equipment installation will require at least one man's full time, especially while the network is being expanded. Peak efficiency is demanded of all units, both transmitting and receiving, if good rural coverage is to be maintained. Such performance cannot be expected unless frequent routine adjustments are made and proper servicing instruments are used.

Operation and Coordination

The E.E.I. interpretation of the F.C.C. limitations for "Special Emergency" stations has been accepted as the operating guide. The load dispatchers and others using this service now hold radio telephone operators' permits and the entire radio system is under the control of a radio telephone first-class operator.

Communication engineers familiar with the congestion on the special emergency channel at 2726 K.C. cannot too forcibly impress upon the users and future applicants for either of the two full-time medium frequency assignments, the importance of proper antenna design. Careful consideration of this problem



not only facilitates the communication desired, but is the step toward that necessary cooperation with other services using the same channel.

The low-angle radiation characteristics produced by the fractional wave vertical type antenna, with the proper ground system, are ideal for trouble dispatching purposes. The low power limitation on the 2292 K.C. channel should not be considered as a service limitation; the tendency will be to create better unit efficiency for the service desired, resulting in reduced interference when the channel becomes congested.

Equipment Costs

Equipment costs will obviously vary with the system used and coverage required and where good transmitter and receiver locations are available, more coverage per unit may be expected. The approximate cost of the network herein described can be itemized as follows:

Fixed transmitter 2,292 K.C., 150 watts (operating on 50 watts)	
Transmitter unit—installed	$ 800.00
Relay rack and central office control	400.00
Housing and pole installation	400.00
Total	$1,600.00
Fixed receiver 31,740 K.C.	
Receiver unit	$ 170.00
Antenna installation (no pole involved)	50.00
Total	$ 220.00
Mobile one-way units	
Receiver unit with antenna—installed	$ 55.00
Mobile two-way units	
Transmitter unit with antenna—installed	$ 350.00
Receiver unit with antenna—installed	55.00
Oversize battery and generator—installed	85.00
Total	$ 490.00

The Power Sales Conference

(*Continued from page* 192)

competitive aspects of Diesel engines in the refrigeration and air-conditioning fields. Walter Moore of Texas Power & Light Co., Dallas, was unable to be at Roanoke to deliver his paper on "Methods of Meeting Competition" and this was presented by J. C. Murtha of Consolidated Edison Co. of New York. The subject of "Steam Competition" was adequately and effectively covered by P. D. Lawrence of Virginia Electric & Power Co., Richmond.

The closing afternoon session included a paper by W. A. Moore, Mississippi Power & Light Co., Jackson, on "Improving Industrial Sales Methods to Increase Net Income" which was presented in his enforced absence by B. M. Davis of the same company; "Selling Electric Service for Refinery Hot Oil Pumps" by W. H. Stueve, Oklahoma Gas & Electric Co., Oklahoma City; "Selling Small Power Applications in Ohio" by E. M. Doran of The Cincinnati Gas & Electric Co., Cincinnati, and "Selling Small Power Applications in Colorado" by Guy C. Thomas of Public Service Co. of Colorado, Denver. Mr. Thomas was unavoidably detained and sent his representative J. W. Hart who proved an effective pinch-hitter.

A review of the program will show a wide range of thinking on the problems involved in power sales. General discussion of the papers was in order as a final number, but unfortunately not enough time was available to examine the provocative points included in the ably prepared messages, and to delve into the many intimate details of contact with the industrial consumer. However, there was opportunity outside of the regular sessions for this valuable interchange of thoughts and experiences in the promotion and sale of Purchased Power.

A banquet was held on the evening of April 25 with C. A. Collier, Vice President of Georgia Power Co., Atlanta, Ga., as the featured speaker of the evening. Mr. Collier brought a thoughtful and helpful message to the salesmen which was enthusiastically received. C. E. Greenwood, Commercial Director of Edison Electric Institute, was Toastmaster of the evening.

This brief outline of the Power Sales Conference would be incomplete without mention of the splendid assistance of J. W. Talley, Secretary of the Southeastern Electric Exchange, who was responsible for arrangements, and registration. Likewise a word of commendation to Francis McQuillen of West Penn Power Co., Pittsburgh, in charge of music at the Banquet, together with Vernon Tallman of Boston, Chorister.

In other columns of the Bulletin one will read the presentations of several of the speakers on the program. The complete Proceedings have been reproduced and are available to those who registered at the Conference.

P. E. A. Operations Section Meeting

THE new utility employee and the importance of his first experiences in the industry received the initial attention of the operations section of the Pennsylvania Electric Association in its meeting April 24, at Johnstown. Case histories were used as a basis for determining effective ways of breaking in new employees and checking on their performance.

The current vogue of quiz programs has been capitalized by the Philadelphia Electric Company as groups of linemen, assembled for training, check "True" or "False" to statements like "When connecting a two-phase transformer installation to energized two-phase, five-wire secondary mains, it is not necessary to connect neutrals before phasing." Following a description of these non-collected, anonymous quizzes by L. E. Goodenough, supervisor of training, a second P. E. Co. speaker, Dr. M. S. Viteles, director of personnel research and training, outlined the company's "self-audit" plan for employees.

The sessions opened with the spotlight on the frequently overlooked needs of the new employee, with papers on the new district office clerk, the new meter reader and the new groundman. The importance of the first experiences of the new employee with his new industry and new utility was stressed by Division Manager H. G. Wilhelm of Pennsylvania Electric Co. West Penn Power's District Manager J. V. Soisson described the selection and training of meter readers, with emphasis on keeping them posted.

"Here's How We Quit Irritating Our Customers" was a symposium at which Henry Flanagen described the Philadelphia Electric customer contact supervision procedure, W. E. Sturm of West Penn showed how it was possible to omit superfluities like residential contracts for service, delays in connecting new service and unnecessary requests for service deposits.

P. H. McCance, senior vice-president of Duquesne Light, principal speaker at the luncheon, surveyed human relations in the utility industry. H. K. Breckenridge of West Penn and chairman of P.E.A. operations section presided at the meetings.

ACCOUNTING NOTES

Calendar of Events

Several accounting meetings or meetings of associations of which accounting is a part have been held this year and the following which have come to our attention are listed for the information of those who might wish to obtain further information regarding the program, published proceedings, etc.:

Jan. 24-25, New York City, Conference on "Financial Management," American Management Association, 330 West 42nd St., New York City.

March 28-29, New Orleans, La., Accounting Meeting of the Southeastern Electrical Exchange, Chairman, Herman W. Boozer, Georgia Power Company, Atlanta, Ga.

April 11-12, White Sulphur Springs, W. Va., Spring Accounting Conference, American Gas Association, F. B. Flahive, Chairman, Columbia Gas & Electric Corp., 61 Broadway, New York City.

April 25-26, Kansas City, Kan., Missouri Valley Electric Association, Secretary, Thorne Browne, 1527 Sharpe Bldg., Lincoln, Neb.

April 25-26, New York City, "Corporate Financial Statements," Accounting Institute, Columbia University, New York City.

May 23-24, Benson Hotel, Portland, Ore., Northwest Electric Light & Power Association 15th Annual Meeting, "Accounting and Business Practice Section."

"Chairman Ralph Lawlor has commitments for the covering of these important subjects: Uniformity in Accounting for Merchandising and New Business; Accounting for and Recording Contributions for Line Extensions; Allocation of General Expense to Construction Accounts; Status of Salaried Employees under Wage and Hour Law; Depreciation Accounting; Deposit Requirements for Customers' Service Accounts; Effect on Public Relations of a Firm and Fair Collection Policy; Coordination between Accounting, Sales and Engineering Department, with a sales manager and an engineer taking part.

"Executive thinking on the pressing problems now faced by utility managements will be voiced by J. E. E. Royer, President of the Northwest E. L. and P. Association, and the chief executive of one of the Portland companies."

Accounting Activities

Messrs. B. S. Rodey, C. E. Kohlhepp and H. C. Davidson of the EEI Accounting Committees, as well as Mr. C. L. Campbell, President of the Connecticut Light & Power Company, will address the 1940 Convention of the EEI to be held in Atlantic City on June 3 to 6. The General Accounting Committee will hold a luncheon meeting at the Hotel Traymore on Monday, June 3.

Rodey Honored

Mr. Bernard S. Rodey, Jr., who has been chairman of the General Accounting Committee for the past three years and is largely responsible for the increased accounting activities of the Institute, was guest at a surprise dinner held at the Engineers' Club, New York City, on the evening of May 2, attended by some twenty accounting people. Mr. Rodey was presented with a handsome wrist watch.

Contributions by Accounting People

Members of the General Accounting Committee have supplied the following notes:

Attention is directed to the following excerpt from Opinion 34 of the Federal Power Commission dated Nov. 1, 1938: Re Application of Kansas Gas and Electric Company involving the question of the FPC's jurisdiction:

"The Commission is of the opinion that in the broad grant of authority applying the provisions of Part II of the Act to the 'transmission of electric energy in interstate commerce' Congress intended to cover all cases where electric energy is conveyed across state lines whether the conveyance be by so-called transmission facilities or by distribution facilities. There is nothing in the Act or in its legislative history to indicate that Congress intended to draw any nice distinction between transmission and distribution as related to the conveyance of energy across state lines. *Indeed, the extensive expert testimony introduced in this case by both the applicant and the Commission serves only to demonstrate that no clear-cut differentiation between these terms is recognized either in the industry generally or even among technical experts themselves.*" (Italics supplied).

Attention is directed to the contrast between the importance attributed to the distinction between transmission and distribution in the FPC system of accounts and the above opinion.

Brushing aside the usual phrases of "splendid cooperation" and "substantial progress," Mr. B. S. Rodey reviews in the forthcoming EEI convention number of *"Electric Light and Power"* the accounting activities of the Institute during 1939-1940. The results must have been extraordinary, as he feels justified to refer to the various committees as "study groups." Improvement and simplification of methods appear to have been of prime concern. High points of accounting activities were the Third National Accounting Conference in Chicago and two joint meetings on depreciation problems with representatives of the AGA and the NARUC.

Accounting for Vacation Time

In days gone by only the salaried "white collar" employee, generally speaking, was granted an annual vacation with pay. The accounting for this was not difficult as the time of such employees usually was not diversified, being chargeable to a few, often only one account.

Now that labor generally, including hourly rate employees, whose time is often largely diversified and often divided between operating and fixed capital accounts are granted such vacations, there arises a problem for the accountant.

It is apparent that the old practice is not readily applicable to these hourly rate employees whose time over the year is chargeable to many accounts both in the operating and fixed capital divisions. Likewise such time cannot be charged to the job on which the employee was engaged at the time of his vacation without in many cases causing undue distortion in costs and producing sometimes ridiculous results in fixed capital costs and reflected in continuous property records by units.

A number of solutions have been suggested such as charging all vacation time to "Employees Welfare Expense" or to "Miscellaneous General Expenses." Such solutions do not seem equitable because they disregard the fact that fixed capital accounts should bear a proper portion of the cost of vacation expense. In this connection attention is called to General Instruction No. 2, paragraph F and General Instruction No. 11 of the National Association of Railroad and Utilities Commissioners' uniform classification of accounts.

To a number of accountants the most equitable way to treat this matter appears to be to establish a "reserve account" against which all vacation costs and dismissal pay will be charged as paid. The credits to the reserve arise from the payroll distribution by loading each account with an estimated percentage representing the cost of vacation time. The balance in the "reserve account" must be closely watched particularly near the close of the general vacation period and must be adjusted for the remainder of the year so that at the close of the year the balance will be negligible.

It will be of interest to have the views of others in regard to this matter.

INDUSTRY ACCOUNTANTS

Please forward comments, suggestions and notes for use in this column in subsequent issues of the BULLETIN *to Mr. Bernard S. Rodey, Jr., Chairman, General Accounting Committee, 420 Lexington Avenue, New York, N. Y.*

PUBLICATIONS OF THE INSTITUTE

Pub. No.		*Date Issued*	*Price to Members*	*Price to Non-Members*	*Price to Foreign Countries*
H1	Test Specifications for Household Electric Ranges	(5/40)	$0.20	$0.50	$0.60
H2	Electric Light and Power Industry in 1939	(3/40)	.30	.75	.85
G1	A-C Network Operation, 1936–1937	(8/39)	.80	2.00	2.10
G2	The Electric Light and Power Industry in 1938	(5/39)	.30	.75	.85
G3	Combustion—1939	(12/39)	.80	2.00	2.15
G4	Electric Metal-Melting Furnaces	(1/40)	.80	2.00	2.15
G5	Cable Operation—1938	(1/40)	.60	1.50	1.60
G6	First Report of E.E.I.-N.E.M.A. Joint Committee on Standards for Distribution Transformers	(2/40)	.25	.60	.70
G7	Turbines, Condensers and Pumps—1939	(1/40)	.70	1.75	1.85
G8	Electrical Metermen's Handbook	(4/40)	2.40	3.60	4.00
G9	Methods of Measuring Radio Noise	(2/40)	.20	.50	.60
G10	Boilers, Superheaters, Economizers, Air Heaters and Piping	(4/40)	.80	2.00	2.15
F1	Treatment and Inspection of Creosoted Pine Poles	(2/38)	.30	.75	.85
F2	Inductive Coordination of Rural Power and Telephone Systems	(1/38)	.80	2.00	2.15
F3	Distribution Transformer Load Characteristics—1938	(4/38)	1.00	2.50	2.65
F4	The Electric Light and Power Industry in 1937	(4/38)	.30	.75	.85
F5	Design of Switchhouses for Generating Stations and Transmission Substations	(6/38)	.40	1.00	1.10
F6	Lightning Proof Transmission Lines	(7/38)	.60	1.50	1.60
F7	Economical Distribution Transformer Loading and Thermal Performance of Distribution Transformers	(8/38)	.40	1.00	1.10
F8	Test Specifications, Automatic Electric Storage Water Heaters	(10/38)	.20	.50	.60
F9	Conductor Sags and Tensions for Rural Lines	(10/38)	.40	1.00	1.10
F10	Tree Trimming Practices	(10/38)	.20	.50	.60
F11	Electrification of Oil Refineries	(10/38)	.30	.75	.85
F12	Combustion—1938	(11/38)	1.00	2.50	2.65
F13	Reconditioning Flood Damaged Electrical Equipment	(12/38)	.30	.75	.85
F14	Turbines, Condensers and Pumps—1938	(12/38)	.70	1.75	1.85
F15	Boilers, Superheaters, Economizers, Air Heaters and Piping	(3/39)	1.00	2.50	2.65
F16	Cable Operation—1937	(3/39)	.60	1.50	1.60
F17	Short-Circuiting Relay Protectors—Engineering Report No. 41 of the Joint Sub-Committee on Development and Research	(8/38)	.40	1.00	1.10
E1	Rectifier Wave Shape	(4/37)	.40	1.00	1.10
E2	The Electric Light and Power Industry in 1936	(1/37)	.30	.75	.85
E3	Jointly Used Wood Pole Lines Specifications	(1/37)	.50	1.50	1.60
E4	Joint Use of Poles, 6.6 and 13.2 Kv, Safety Features	(1/37)	.30	.75	.85
E5	Principles and Practices for Inductive Coordination, A.A.R. and E.E.I.	(1/37)	n.c.	n.c.	n.c.
E8	A-C Network Operation—1934–1935	(6/37)	.70	1.60	1.75
E9	Characteristics of Power System Faults to Ground—Engineering Report No. 39 of the Joint Subcommittee on Development and Research	(11/37)	.60	1.50	1.60
E10	Power Station Chemistry—1937	(9/37)	.30	.75	.85
E11	Combustion—1937	(9/37)	.80	2.00	2.15
E12	Resuscitation Booklets	(7/37)	1-9 copies .10 each 10-99 copies .08 each 100-499 copies .06 each 500-999 copies .04 each		
E14	Turbines, Condensers and Pumps—1937	(9/37)	.60	1.50	1.60
E15	Oil and Gas Engines—1936–1937	(10/37)	.40	1.00	1.10
E16	Boilers, Superheaters, Economizers, Air Heaters and Piping—1937	(12/37)	.90	2.35	2.50
TD1	Suggestions for Specifications for Bolts and Nuts	(5/37)	.20	.20	.20
TD2	Suggestions for Specifications for Anchor Rods	(6/39)	.10	.10	.10
TD3	Suggestions for Specifications for Lag Screws	(10/38)	.10	.10	.10
TD4	Suggestions for Specifications for Eye Bolts	(6/39)	.10	.10	.10
TD6	Suggestion for Specifications for Steel Crossarm Braces	(5/40)	.10	.10	.10
TD10	Suggestions for Specifications for Rolled Steel Washers	(5/40)	.10	.10	.10
TD51	Suggestions for Specifications for Low and Medium Voltage Pin Type Insulators	(5/37)	.10	.10	.10
TD71	Suggestions for Specifications for Insulator and Pin Threads and Gauges	(5/37)	.10	.10	.10
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PERSONALS

WENDELL WILLKIE, president, Commonwealth and Southern Corporation, has received the gold medal of the National Institute of Social Sciences, "for distinguished service to humanity." The presentation took place at the organization's annual dinner in New York, May 7. The citation accompanying Mr. Willkie's award read as follows:

"Wendell L. Willkie, lawyer, eminent public utilities executive, outspoken defender of individual freedom and enterprise, who, by his speeches and writings, has made a vital contribution to the maintenance of government under the Constitution."

P. S. ARKWRIGHT, president, Georgia Power Company, has been named general chairman of the drive for $1,300,000 to establish a university center for the Southeast, to be located in Atlanta.

R. GILMAN SMITH, for several years a director of United Light and Power Company and of American Light and Traction Company, has been elected a vice-president of each company.

Tribute was paid veteran employees of the Utah Power & Light Company for outstanding public service at the company's annual veterans' banquet honoring the class of 1939 in Salt Lake City recently.

HENRY STEVENSON, who completed 40 years of service in 1939 as power station operator, was presented with a diamond-studded service pin by George M. Gadsby, president and general manager. Other honored special guests were JOHN Y. ROBBINS, 54 years of service; THOMAS R. THOMAS, 49 years; HENRY ARNOLD, 48 years; W. R. WILLIAMS, 48 years; CLARENCE A. HANSEN, 44 years; A. E. BUCKLER, 43 years; FRANK E. DUSENBERRY, 42 years; and WILLIAM EDWARDS, 41 years. Dr. Adam S. Bennion, assistant to the president, was principal speaker and L. W. Nims, manager of the Ogden division, was toastmaster.

JOSEPH F. PORTER, JR., vice-president of Kansas City Power & Light Company, has been appointed chairman of the Commercial Electric Cooking Council, succeeding P. M. Alden, Philadelphia Electric Company. Mr. Porter's utility background dates from 1921 and includes two terms as president of the Electric and Radio Association of Kansas City. He is widely known throughout the electrical industry.

JOHN S. DAVIDSON, who has been connected with the Pennsylvania Power and Light Company since 1935, has been appointed manager of the Hazleton division. He was promoted to district manager at Allentown about a year ago, after serving in the sales department there.

Philadelphia Electric Company has announced several changes in its operating staff.

RAYMOND BAILEY, formerly assistant electrical engineer, electrical engineering division, has been appointed purchasing agent. LEWIS R. GATY, formerly assistant to general superintendent, transmission and distribution, suburban divisions, succeeds Mr. Bailey as electrical engineer. W. G. STEINBRIGHT, formerly division superintendent, eastern division, has been, in turn, named to succeed Mr. Gaty. C. E. NELSON, formerly superintendent of the service maintenance division, takes Mr. Steinbright's former post as superintendent of the eastern division; and R. P. BROTZMAN moves up from the position of assistant superintendent to that of superintendent of the service maintenance division.

HAROLD G. HAYDON, controller, Potomac Electric Power Company, Washington, D. C., was elected president of the Maryland Utilities Association at the recent annual convention in Baltimore. Mr. Haydon entered the employ of Potomac Electric Power Company in 1910, becoming controller in 1933.

A. P. GALE, executive vice-president of the Wisconsin Power and Light Company, was elected president of the Wisconsin Utilities Association in the association's annual ballot by mail. He succeeds BRUNO RAHN, who has been president for two years, and who becomes chairman of the Advisory Committee. LOUIS T. SMITH, secretary and treasurer, Milwaukee Gas Light Company, was elected treasurer, succeeding John Dockendorf. The new officers were installed at a dinner in Milwaukee on May 9.

RALPH E. MOODY has been appointed assistant to the president, The North American Company, and has resigned positions as assistant to the president, Wisconsin Electric Power Company, and executive vice-president and director of the Wisconsin Gas and Electric Company and of the Wisconsin Michigan Power Company. All these companies are members of the North American system.

STANLEY B. SHERMAN, vice-president and general manager, Wisconsin Gas and Electric Company, has been elected a director of that company and appointed chief operating officer, succeeding to duties previously performed by Mr. Moody.

WILLIAM E. SCHUBERT, vice-president and general manager, Wisconsin Michigan Power Company, has been elected a director of that company and appointed its chief operating officer.

LAWRENCE F. SEYBOLD, vice-president, Wisconsin Electric Power Company, has been elected vice-president also of Wisconsin Gas and Electric Company and of Wisconsin Michigan Power Company. He is also the new vice-president of the Wisconsin Utilities Association.

HENRY B. BRYANS, executive vice-president, Philadelphia Electric Company since 1938, has been elected to the board of directors of that company.

RUSSELL POE has been appointed purchasing agent of the West Penn Power Company, after having served as assistant purchasing agent for a number of years.

EARL C. SANDMEYER, formerly financial editor of all the Gannett newspapers and latterly a member of the financial staff of the New York *Herald-Tribune*, has accepted employment with the North American Company, where he will work under the direction of Edward L. Shea, president.

FRED W. HOLZ, JR., has joined the Ashton B. Collins organization, Birmingham, Ala., and will work in the expansion of the "Reddy Kilowatt" program. Mr. Holz was connected with the Edison Electric Institute commercial department for a number of years. Among his other duties, he was secretary of the Commercial Cooking Council.

NEW PUBLICATION

Boilers, Superheaters, Economizers, Air Heaters and Piping, 1939.

EEI. Pub. G-10. A report of the Boilers Subcommittee of the Prime Movers Committee, Edison Electric Institute, 35 pages. Price 80¢ to members and their employees; $2.00 to non-members in the U.S.A.; $2.15 to foreign countries.

THIS report contains statements by the subcommittee, operating companies, and manufacturers, covering operating and design problems related to boilers, superheaters, economizers, and auxiliaries which are of particular concern to operators of steam-generating equipment at this time, together with descriptions of new developments.

Resuscitation Review Board

(*Continued from page* 234)

determined entirely by the interest of all those who are in a position to make reports on cases that do occur and especially on the accuracy of the data furnished.

"It is requested that all electric utility company representatives who have any responsibility for such a matter as this familiarize themselves with the contents of the Field Report Form, particularly Section III, in order that there shall be an understanding of the details on which information is especially desired. Field Report Forms will be available at Institute Headquarters in the near future.

"On behalf of the Institute and the Accident Prevention Committee it is my pleasure to express to Dr. Williams and all of those who will be associated with him sincere appreciation of their interest and our thanks for their acceptance of our invitation to cooperate with us on this investigation."

Electric Utility Wages at Record High

Weekly earnings of wage-earning employees in the electric and manufactured gas utilities have risen from a low point of $28.72 in 1933 to an average of $33.81 in 1939, according to statistics published by the U. S. Department of Labor. The present level of electric utility wages is 37½ per cent above the earnings of the average employee in general manufacture, who is still 69c below his high record of $25.26 in 1929.

During the worst part of the depression, the earnings of the industrial worker were radically reduced through curtailment of working hours and fell from $25.26 in 1929 to $17.45 in 1932—a decline of 31 per cent. During this same period, however, the weekly pay envelope of the electric utility worker decreased from $31.07 in 1929 to $28.72 in 1933, or by only 7½ per cent.

CONVENTIONS AND MEETINGS

MAY

1-3	American Society of Mechanical Engineers, Spring meeting, Worcester, Mass.
6-7	American Management Association, Insurance Division, Hotel Traymore, Atlantic City, N. J.
6-9	Technical Committees, E.E.I., Edgewater Beach Hotel, Chicago, Ill.
8-11	National Fire Protection Association, Atlantic City, N. J.
9-11	Southeastern Electric Exchange, Hotel Roanoke, Roanoke, Va.
10-11	Air Conditioning Manufacturers Association, The Homestead, Hot Springs, Va.
12-17	National Electrical Manufacturers Association, The Homestead, Hot Springs, Va.
14-17	National District Heating Association, French Lick Springs Hotel, French Lick Springs, Ind.
17	Empire State Gas and Electric Association, Electric Operating Group, New York, N. Y.
19-20	South Dakota Central Station Conference, Sioux Falls, S. D.
19-23	National Electrical Wholesalers Association, The Homestead, Hot Springs, Va.
22-24	Pacific Coast Electrical Association, Hotel Oakland, Oakland, Calif.
23-24	Northwest Electric Light and Power Association, Accounting and Business Practice Section, Benson Hotel, Portland, Ore.
23-24	Public Utilities Advertising Association, Palmer House, Chicago, Ill.
24-28	Westinghouse Agent-Jobbers Association, The Homestead, Hot Springs, Va.

JUNE

3-6	EDISON ELECTRIC INSTITUTE, Atlantic City, N. J.
3-6	National Association of Purchasing Agents, Cincinnati, Ohio.
13-14	Institute of Cooking and Heating Appliance Manufacturers, Cincinnati, Ohio.
24-27	National Association of Cost Accountants, St. Louis, Mo.
25-28	Canadian Electrical Association, Seignoiry Club, Province of Quebec, Canada.

SEPTEMBER

4-6	Pennsylvania Electric Association, Bedford Springs Hotel, Bedford Springs, Pa.
9-12	Illuminating Engineering Society, Essex and Sussex Hotel, Spring Lake, N. J.
25-27	Indiana Electric Association, French Lick Springs Hotel, French Lick Springs, Ind.
26-27	The Empire State Gas and Electric Association, Westchester Country Club, Rye, N. Y.

OCTOBER

7-10	American Gas Association, Atlantic City, N. J.

Wealth, Debt and Taxes in the United States

Public debt in the United States is now 10 times as great as it was in 1913, just before the last war, according to "Studies in Enterprise and Social Progress," a publication of the National Industrial Conference Board. The debt now equals 18 per cent of the total national wealth, as compared with only 3 per cent in 1913, the debt itself having increased nine-fold meanwhile.

Taxes now take 21 per cent of the national income each year. Ten years ago taxes took only 12 per cent of the national income and in 1913 only 6 per cent. Every dollar of national wealth must produce more than 4 cents every year to meet taxes alone. The steady increase in both debt and taxes since the beginning of the century is shown in the following table:

Year	National Wealth	Public Debt Total	Public Debt % Wealth	National Income	Taxation Total	Taxation As % Income	Taxation As % Wealth
	——million $——			——million $——			
1902	101,000	3,043	3.0	17,800*	1,393	7.8	1.38
1913	200,000	5,721	2.9	35,400	2,182	6.2	1.10
1919	280,000	32,524	11.6	60,000*	6,742	11.2	2.41
1929	354,000	33,691	9.5	80,900	9,759	12.1	2.81
1932	299,000	38,817	13.0	47,200	8,146	17.3	2.78
1937	322,000	55,579	17.3	68,600	12,473	18.0	3.87
1938	330,000	56,337	17.1	68,000	14,300	21.0	4.33
1939	.....	59,600*	...	66,300	13,900	21.0	...

*Approximate.

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1939-1940

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